N.A.A. BULLETIN

January
1958

In Two Sections
Section 1

Full Use of the Budget

•

"Travel Promotion" Accounting

•

Protective Stock Computation

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Computing Protective Stock By Statistical Methods

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WE HAVE DEVELOPED and shaken down to practical usefulness a number of ideas and techniques dealing with the control of product inventories. The ideas are based on the use of statistical analysis techniques for measuring and predicting the probability distribution of sales i.e., the pattern of sales in relation to the average. These analytical tools permit the setting of realistic inventory standards which are not only flexible but also carefully designed to meet the level of customer service fixed by management.

The usual rules and procedures for developing inventory standards either neglect the effect of variations in sales opportunities on inventory levels or, at best, take them into account in an intuitive rather than quantitative way. If realistic inventory standards are to be maintained, quantitative methods, such as those based on probability distributions, must be employed to take direct account of problems of sales uncertainty.

The total inventory of a typical product stored at a warehouse is normally made up of (1) protective and order cycle stock at the warehouse and (2) stock in transit. Special inventories may also be carried at the warehouse in the form of stockpiles to meet a planned intensive sales campaign, to protect sales against plant maintenance shutdowns, or to anticipate seasonal fluctuations in sales. These are anticipation stocks. The in transit stocks and the order cycle stocks are functions of the product sales rates and the response characteristics of the marketing system and can readily be sized from this data. The sales variability is the most important factor in setting protective stocks, however. But this must be done from the limited information available to the seller who can accomplish the control of inventory only by adjustment in input rate. He must control input in the light of the variability or uncertainty in the output rate. Control of inventory stock and also scheduling the production of the product are both involved.

Frequency Distribution Applied to Sales Data

By examining the pattern of past sales of the product to the customers and measuring the variation in sales by use of the statistic called the standard deviation from the mean, the effect of sales uncertainty can be applied to the

VERNON A. RUTHERFORD is Chemical Engineer in the Control Division, Polychemicals Department, E. I. duPont de Nemours & Co., Wilmington, Delaware. He joined duPont's Polychemicals Department in 1948. Prior to joining the Control Division, Mr. Rutherford had had experience in chemical plant operation, cost analysis and project engineering work.

development of protective stock. This sales variability k, can be expressed as:

$$k = \frac{\acute{o}}{\overline{X}}$$ where $\acute{o}$ is the standard deviation from the average sales rate and $\overline{X}$ is the average sales rate. (1)

Statistical methods, such as those embodied in the foregoing formula, apply mathematical probability to the interpretation of results. A frequency distribution is one method of arranging or classifying information, such as sales data, for better interpretation. With this device, the various items in a sample of data are classified into groups and the frequency of occurrence is recorded in each group. The first and most important parameter obtained from this grouping of sales data is the average value or arithmetic mean. The second is the variance, which measures the spread, or dispersion, of values about the arithmetic mean of the data. The variance is the arithmetic mean of the squares of the deviations of the various items from the arithmetic mean of the whole. However, as a result of the squaring operation, the result cannot be immediately applied to set upper and lower limits around the average. It is customary, therefore, to extract the square root of the variance and obtain the unit on the same scale as the original measurement. The result of this operation is called the standard deviation or the standard error. It can be determined from group sales data by the following equation:

$$\acute{o} = \sqrt{\frac{n \Sigma (X_1)^2 - (\Sigma X_1)^2}{n\ (n-1)}}$$ (2)

where n in the number of time intervals in which sales rates are measured and X_1 are the individual sales rates for the time intervals selected for the sample.

Examination of a group of sales statistics for a product indicates that most individual sales rates during a series of time intervals cluster about the average for the group. Individual rates that differ little from the average are more frequent than measurements which differ considerably from the average. It is

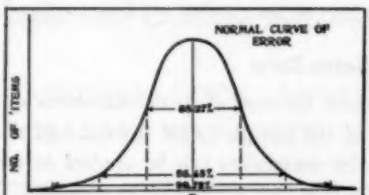

EXHIBIT 1

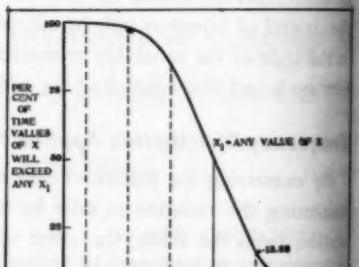

EXHIBIT 2

possible, using a mathematical rule called the normal law of error, to relate the frequency of occurrence of a sales rate to the amount by which it differs from the average sales rate. The normal law of error can be represented graphically by the normal curve of error (Exhibit 1). Along the abscissa are plotted the individual sales rates for the time intervals. The ordinates are the number of items or the frequency of occurrence of the individual sales rates. The maximum frequency is at the average sales rate $\overline{X}$. The importance of the normal distribution lies in the fact that we can fit such a curve of the sales data to a frequency distribution by estimating the average sales rate and the standard deviation. Fitting a curve to a frequency distribution affords several advantages such as:

1. Enabling us to generalize concerning the proportion of items which should be expected to fall above, below or between certain values.
2. Enabling us to determine the probable distribution of values in closely associated series.

The normal curve of error is firmly grounded in experience. Unless the data at hand cast doubt on the normal frequency distribution, it is assumed to apply even to sets of data too small to reveal their approximate conformance. The major use of this curve is in determining what portion of the number of items (i.e., sales rates) lies between the average $\overline{X}$, and some other rate X. For example, 68.3 per cent of all the sales rates will fall within the limits of $\pm$ 1 standard deviation. The proportion of items included within $\pm$ 2 and 3 standard deviations can also be estimated from the normal curve of error.

The frequency distribution can also be expressed in the form of an "S" shaped curve as in Exhibit 2. Here individual sales rates X are plotted against the per cent of the time that other values of the sales rate X will exceed any individual sales rate X_1. The average or mean sales rate is located at $\overline{X}$. Of the sales rates in the sample, one-half will exceed the average and one-half will be smaller. Approximately 16 per cent of the sales rates will be greater than $+$ 1 standard deviation. The percentages of sales rates greater than $+$ 2 and $+$ 3 standard deviations are 2.3 and .14, respectively.

It is the section of the normal curve above $+$ 2 standard deviations that is useful in setting protective inventories. For example, if the inventory stock at a warehouse is equal to the average sales rate $\overline{X}$ in a given time interval, there will be other sales rates in the time interval large enough to deplete the stock 50 per cent of the time. On the other hand, there will be adequate stock to handle the expected sales rates 50 per cent of the time. If the inventory is set at a level corresponding to two standard deviations above the average, the

probability of having time intervals with sales rates that deplete the stock is 2.3 per cent. With an inventory three standard deviations above the average sales rate, even better protection is possible. The probability of running out of stock in the time intervals is now only .14 per cent. The probability of "stock-outs" occurring at any other inventory stock levels can also be determined.

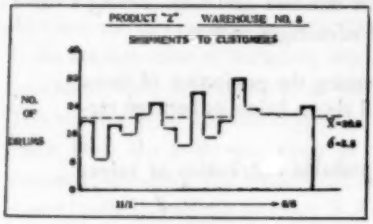

EXHIBIT 3

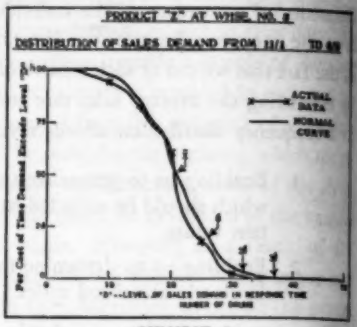
PRODUCT "Z" AT WHSE. NO. 8
DISTRIBUTION OF SALES DEMAND FROM 11/1 TO 6/8
ACTUAL DATA
NORMAL CURVE
Per Cent of Time Demand Exceeds Level

EXHIBIT 4

An Application to Warehouse Stock

These statistical data in the hands of the operator of a warehouse give him a quantitative method of setting inventories which takes into account the risk of incurring lost sales. The portion of the inventory from the average sales rate $\overline{X}$ to the level of risk that is used (i.e., the number of standard deviations) is the protective inventory.

On Exhibit 3 are plotted the shipments of Product Z to customers from Warehouse 3 in each of the sales periods from November 1 until June 8 of the following year. These sales periods are all 9 working days in length. This is the time it takes to replenish Warehouse 3 with stock from the plant or central warehouse after the replenishment order has been placed. This 9 working day period is known as the response time and there are 17 of these time periods from November 1 until June 8. The sales of Product Z in the periods fluctuate about an average value of 20.6 drums and vary from 9 drums to 32 drums. The variable sales rates shown here make up the statistical sample. The frequency distribution is assumed to be normal and, by substituting in Equation 2, a value of 5.5 drums is obtained for the standard deviation $\acute{o}$.

When the frequency distribution of the individual shipments is plotted in the form of an "S" shaped curve, the results are as in Exhibit 4.

Although the curve drawn from the actual sales data does not conform exactly to the normal curve plotted from the standard deviation data, it does approximate it very closely. Thus, the assumption that the sales data obey a

normal distribution is correct. The normal curve can then be used for establishing the probability of future sales rates exceeding any particular level of warehouse inventory. On the ordinate is plotted the per cent of time that the sales rates exceed inventory level D, and the abscissa is inventory level D, or the level of sales in each of the response time periods. The average sales rate $\overline{X}$ was 20.6 drums and inventories at 1, 2, and 3 standard deviations above the average can be tested to determine the probability of encountering stock depletions. For example, at a warehouse inventory of 32 drums (2 standard deviations above $\overline{X}$), the probability of having a sales rate higher than 32 drums is 2.3 per cent or only 2.3 out of every 100 time intervals will have sales rates exceeding the available inventory. At an inventory of 37 drums (3 standard deviations above $\overline{X}$), a stock depletion will occur in only 1.4 out of every 1000 time intervals.

Thus, the data plotted in the normal curve of error, particularly in the range of + 2 to + 3 standard deviations, provides the basis for setting the protective inventory. The exact level of stock to inventory can be determined by evaluating the carrying costs and the expected lost sales penalty. The protective inventory can be defined as:

$I_p = k \cdot \overline{X}_t \cdot X_o$ where K is the sales variability, δ / X, $\overline{X}_t$ is the forecast average sales rate and X_o is the level of protection or the optimum number of standard deviations above the average sales rate. Equation (3)

Sales personnel must forecast as accurately as possible the expected average sales rate for the response periods. With any product being sold from a warehouse, there is a relationship existing between the sales uncertainty, the unit marginal costs, the response time, and the order size. When these factors are known, it is possible to determine the optimum level of protection (i.e., that point where the expected penalty averted by increasing the stock level by an incremental amount is equal to the expected incremental carrying cost) by use of the following equation:

$$M(X_o) = \frac{R \times c \times T \times U}{B \cdot m \cdot \overline{X}_t} \qquad (4)$$

where

$M(X_o)$ is the incremental inventory criterion function.

R is the acceptable return on the marginal cost invested in the inventory stock.

c is the marginal cost of the replenishment stock delivered to the warehouse.

T is the response time.

U is the order size.

B is the "missed opportunity value factor."

m is the unit marginal earnings.

$\overline{X}_t$ is the average sales opportunity forecast for T.

By inserting the proper values for the symbols on the right hand side of the equation, a value for M (X_o) is obtained. The corresponding value of X_o can be found from tables or graphs of M (X_o) vs. X_o. (See Exhibit 5). The value X_o so found is the optimum level. The real cost of change in inventory is only the change in the variable or marginal cost of manufacture and delivery to the stock point. In appraising the value of lost sales opportunities, it is quite clear that the marginal earnings loss (i.e., the difference between selling price f.o.b. the stock point and the marginal cost delivered to the stock point) reflects only immediate out-of-pocket loss and does not take good will into account. Occasionally, it is necessary to use a "missed opportunity value factor" B, as a measure of the sales missed. This factor, which is quite arbitrary, should be used if the effect of inadequate stock on customer good will is to be given quantitative significance. Estimates of the value to be assigned the factor can best be made by the sales manager. It is normally expressed as the dollar

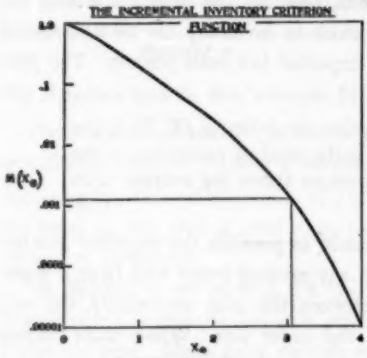

EXHIBIT 5

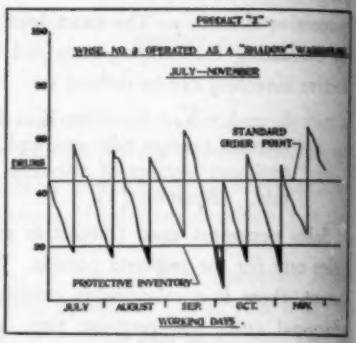

EXHIBIT 6

"value" per dollar of unit marginal earnings. There is no set formula. In the case of Product Z, a factor of 5 was used. This means that a penalty of five dollars was assumed for every dollar of marginal earnings lost. This has the effect of increasing the value for X_o and thereby increasing the size of the protective inventory. With certain products where you are confronted with vigorous and determined competition, a factor of 5 would appear to be quite realistic. In other lines, such as highly seasonal products, the value of a lost sale may depend more on when it was missed than on how much was missed. As the peak of the selling season approaches, the inability to fill a customer's order from stock might lead to loss of his entire business in the future. Here the lost sales value, on a long-term basis, might be several times the short-term marginal earnings missed.

The order size U, for any particular system, can be calculated from the following equation:

$$U = \sqrt{\frac{2\,C_o \cdot X_a}{R}} \qquad (5)$$

where C_o is the cost of ordering lots of replenishment stock X_a is the annual sales rate from the warehouse.

For most distribution systems, however, U is generally set by the marketing conditions of the product. The economic order size becomes the economic transportation size and could be a truck load, a tank car, or even a barge load of material.

The acceptable return on marginal cost invested in inventory stock has been assumed arbitrarily at 20 per cent. It may be more correct to use the actual operative return for each product.

Test of Results Through "Operation Simulation"

If known values for Product X at Warehouse 3 are substituted in Equation (4), M (X_o) becomes .00115 and, as shown on Exhibit 5, X_o has a value of 3.06: Thus, the conditions of manufacturing and marketing Product Z have set the optimum level at 3.06 standard deviations. Finally, the protective inventory, I_p, becomes 20 drums when the values of k, $\overline{X}_t$ and X_o are used in Equation (3). A standard order point for Warehouse 3 can also be set. It will be equal to the protective inventory I_p, plus $\overline{X}_t$, the forecast average sales rate for the time interval T. This is 44 drums for Product Z, and indicates that, when the actual on-hand inventory of Product Z at Warehouse 3 drops to this level, it is time to reorder a replenishment shipment from the plant.

In order to demonstrate that this computed protective inventory and standard order point are valid, short of an actual test, Warehouse 3 was set up as a "shadow" warehouse for a paper study with Product Z. (See Exhibit 6.) This was done for the period from July through November. The "operation simulation" used the computed protective inventory of 20 drums and the standard order point of 44 drums in conjunction with the actual reported sales of Product Z from the warehouse for this period. It was assumed that the on-hand inventory on July 1 was 44 drums, the standard order point, and that a replenishment order was placed that day. On July 13, 9 working days later, this order would have been received and the inventory increased to 58 drums. Then, as additional orders from customers were filled, the inventory level dropped until the standard order point line was crossed and another replenishment order placed on the plant. Additional sales to customers and additional receipts from the plant caused a series of saw-tooth curves which depict the hypothetical day-to-day inventory position of the shadow warehouse.

This graphic portrayal of the effect of methods which have been described will serve to climax this article. Note that there were variations in sales rates during the time intervals in the five-month period. These variations were estimated, however, in setting the protective inventory, since the past sales variability was projected to the future. These estimates proved to be reliable and the protective inventory valid since, at no time during the five months was the shadow warehouse out of stock. We achieved a customer service level of 100 per cent during the 8 time intervals from July through November. The 3.06 standard deviations obtained for X_0 had indicated a probability of stock depletions in only 12 of 1000 time intervals. Since the actual inventory had dropped to 4 drums during early October, it was evident that the protective inventory was serving its purpose —adequate but not excessive stock. From these paper studies then, we conclude that the techniques covered herein have been demonstrated to be operable and are suitable for actual warehouse inventory control.

ERROR SAMPLING IN AUDITING by W. E. GUINN*

STATISTICAL SAMPLING techniques and concepts can be an effective tool for the accountant to use. It has been established that such utilization of statistical sampling is feasible and, further, that these techniques are sound and valid. Hesitation to use them often reflects a distrust in anything that appears too complicated to be easily applied or understood. This is true even when it has been made clear that the sampling techniques will in no way supplant the auditor's judgment (to use the area of application in which statistics has advanced furthest in the accounting field) but, rather, implement it.

Obviously it is impossible, in most instances, for an auditor to examine every transaction reflected in the records. It has long been customary for him to select a representative sample of documents or entries from the various groups and to examine these in some detail, in this way forming an opinion as to the quality of all recordings of the various individual groups. Thus, in a limited and primary way, the sampling statistical technique is applied without use of basic formulas to govern the results of the sampling. So used, it becomes only "a piece of evidence" to be weighed with all other pieces to reach a summary conclusion about the documents or recordings, based on the auditor's judgment.

However, probability is the basic statistical concept which makes it possible to objectively evaluate the extent to which an estimate is likely to be in error. Statistical sampling theory is

(*Continued on page* 26)

* Manager of Internal Auditing of Convair, division of General Dynamics Corp. (Fort Worth).

Organizing Around the Profit Motive — Theory and Application

by RUSSELL E. LARSEN

BEFORE CONSIDERING ORGANIZATION for effective profit control, a company must first determine its objectives or goals. All of us will say that the goal is to make a profit, but that is the grand objective. What are the elements of the goal? What portion of the market is the enterprise to serve? Is this to be changed? Will diversification then need to be considered? Or can the product mix be adapted to this market with existing facilities? Can the market itself be modified by a design or advertising program? Must we add to or delete existing products? Is the problem one of distribution, costs, materials or facilities? How will operating schedules and control become involved?

Profit Awareness, Accountability, Responsibility

After the goal has been identified in terms of the elements which make it up, it is necessary to establish, as a blueprint or plan, the detailed program required. The chief limitations imposed by the existing organization of things should be emphasized to catch and hold the interest of those who are responsible for maximizing profits. This emphasis will focus the attention of all upon organization required to make the plan effective. No two companies will organize identically, for their particular objectives will differ. However, certain principles consistently apply. Some of the most important are outlined below:

1. The further down in the organization that people can be made conscious of and held responsible for profit, the more effective is the organization for profit-making. Because of size and especially in manufacturing companies in which growth has forced the organizations to become "deeper," it becomes necessary to institute a policy of developing an awareness of profit down to the lowest possible rung of the organizational ladder.
2. Clear-cut lines of profit responsibility must be established and communicated. The latter phase is highly important. People at the top may feel that clear cut lines of responsibility have been established, but they have not been established in fact if others do not understand them.
3. A set of measurements must be provided in such a manner that it is possible to measure actual against projected performance. This step will provide everyone having measurable responsibilities with

RUSSELL E. LARSEN is Assistant Controller of American Steel Foundries, Chicago, Illinois. Prior to this he served in previous capacities as Chief Accountant and as Assistant Works Auditor for the Indiana Harbor Works of the same company.

the keys to motivation and action. It is also basic to keeping costs down. The importance of establishing these measurements is that they become an objective framework for success in discharging the responsibilities which, added up, make for realization of the profit goal.

These principles will bear some discussion and elaboration. First, why should the profit motive be brought down to the lowest practical level in the organization? This approach achieves effective profit control in many ways. The first may be largely psychological, in that the individual, consciously or otherwise, is judging his own efforts and is motivated to think of his every action in terms of profit effects. This is very important, because it tends to cause the individual to make decisions and perform his job on the basis of what is best over-all, rather than on what appears to be best for his department. As a consequence, when the profit motive is instilled far down the ladder, many more decisions can be made, and made intelligently, at a relatively low level in the organization. This frees lines of communication for other matters, frees higher levels of the organization to consider other still more important problems and, at the same time, begins to develop individuals for more important jobs in the organization. Within the last four years we have taken quite a few steps of this nature within our company, and although we have a long way to go, we are very much pleased at the results that have been obtained to date.

The second principle stated above is the need to have clear-cut lines of responsibility throughout a company. One of the main purposes of management here is to avoid gaps and overlaps, both of which are confusing and very costly to the profit objective. For these reasons, each member of the organization should be assigned specific tasks which are his responsibilities alone. In addition to eliminating confusion and argument, this permits the individual to specialize effectively in his duties. Most people perform well if they know what is expected of them. This is delegation.

However, it is not all there is to delegation. Some time ago, in one of the publications of the National Industrial Conference Board, there appeared a brief article called, "The Art of Delegation." This article points out that delegation is really made up of three parts. One is responsibility. But there are two other parts, authority, i.e., the rights and powers that the individual needs to carry out his responsibilities, and accountability or the obligation to perform involved in carrying out the responsibility and exercising the authority required. It is here that the principle, that of accountability, listed above, enters and it certainly ties in very closely with the matter of clear cut lines of responsibility. In other words, a man's duties are clearly defined for him, and these duties are

so arranged that the results of his efforts can be measured.

Since we are talking about control, it is really this accountability which interests us. In many ways, it is a peculiar thing within an organization. The "boss" can delegate responsibility. He can also delegate the authority. On the other hand, he cannot delegate his own accountability, nor can the subordinate delegate accountability. That sticks to the person. Accountability applies in the very lowest echelon in the organization and in the very highest, with intermediate steps. The man of the lowest echelon is accountable only, but his superior both receives this accountability as part of his own and is, in turn, accountable to a still higher echelon, until, finally, the board of directors is accountable to the stockholders.

Making Accountability an Accountability for Profit

If an organization is going to perform as it really should, it is important that this accountability be given serious consideration and thought at each of the various levels in the organization. It is important that the accountability be measured in terms of profit as far down as is possible. An obstacle is that accountability of the lowest level of the organization cannot always be measured in terms of profit. For example, the unit foreman will undoubtedly have to be measured on the basis of his manufacturing results, since he has had little or nothing to do with sales policy and probably has had little or nothing to do with the choice of the particular class of product which he is called upon to produce. This is not intended to suggest that the over-all profit motive should not be instilled to the greatest extent possible. However, it would appear, at this level in accountability, that cost control is the most that can be expected, and it is on this basis that performance must be measured. To this end, if the foreman has clearly-defined responsibilities which do not overlap those of others, we are in a position to establish a standard or a measuring stick of some sort against which to judge his performance and thus hold him accountable. It is possible to go somewhat beyond this. He can be made more profit conscious if he is also made to understand how unfavorable variances from standard have caused a reduction in profit. In other words, it is worthwhile to try to tie his results to profit, since the profit is the end, itself, and the control of costs is simply the means to the end.

Likewise, the salesman may have to be judged solely on the volume of business he brings in. However, if his responsibilities are clearly defined and proper information is placed in his hands, he may be judged and held accountable on the basis of his sales in relationship to product lines among which the profit margin varies substantially. Like the unit foreman, the salesman should have his efforts related to profit as closely as possible.

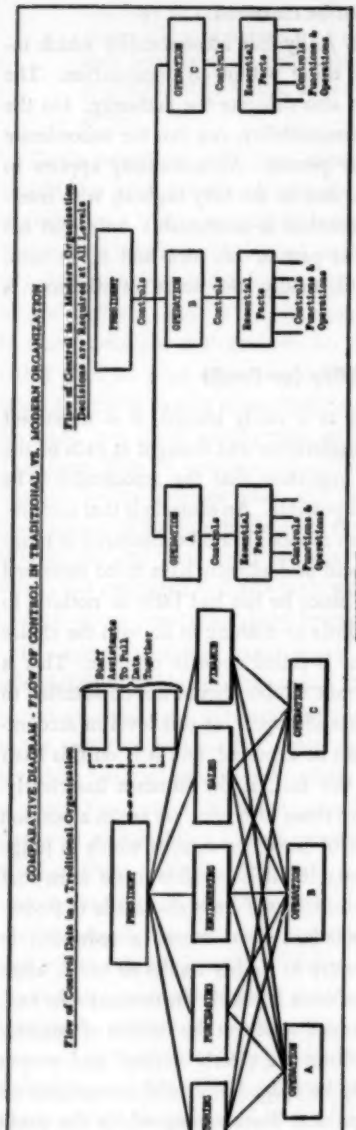

EXHIBIT 1

The above two paragraphs have dealt with front-line personnel devoted to efforts related to profit at a different level. However, it would seem that one should not have to go too far up in the organization before getting to the point at which some individual should be responsible for—and hence accountable for—the profit results in a particular segment of the business. Certain changes within our parent company in recent years may illustrate.

Some years ago, our top level organization consisted of a president, vice presidents in charge of sales, manufacturing, and engineering, a treasurer, a controller, and a secretary. Naturally, if a problem was one of manufacturing, it was the manufacturing vice president's responsibility. If it was one of sales, it was the responsibility of the sales vice president. In other words, each of these top level people, with the exception of the president, was responsible for a particular function of the company, but it was necessary to go up to the president before encountering an individual truly responsible for the profitability of the enterprise or of any of its operations. Under this type of organization, which was prevalent then (and is still too prevalent today), too many decisions had to be made in the president's office. It was humanly impossible for him to make all of these decisions on as broad a groundwork as is possible under the form of organization that we have today.

The changes made are illustrated by Exhibit 1. As a result, today our entire business is organized along operating lines. I use the word "operating" in its broadest sense to include sales, manufacturing, engineering and accounting. Each division has a general manager who reports to a line vice president. Each general manager is, in a sense, the president of a company. He is held responsible for the entire operation as a board of directors would hold the president responsible for the entire company operation. In this situation, the profit motive is uppermost in his mind. He has his own organization to work with and each of these organizations, as a result of breaking the company up in divisions, is smaller and more closely knit. The profit motive is pushed further down in the organization and spread all through it. Each general manager is able to clearly define the responsibilities of each of his direct subordinate and see that they do likewise for their subordinates. By careful attention, responsibility is assigned in such a way that accountability is much easier to attain. Communications within groups of smaller size are better and, as a result, everyone understands better the objective of operations and the plan of how to get there. Constant association of the manufacturing head, for example, with the general manager and with the other department heads develops in him an over-all business viewpoint and makes him more conscious of the profit motive than was possible without such constant association. This diffusion through the company of conscious profit motive is the key to our improved organization.

How the Accountant Should Approach the Reporting Task

The word "control" implies to me checking or regulating or keeping within limits or perhaps, more simply, seeing that things go the way they should. It appears that this is the area in which the accountant serves the balance of the organization in obtaining effective profit control. He is helping keep the organization in balance by reporting on accountability. I should emphasize, too, that the accountant is solely helping or aiding, since he is in a staff position and violates the concepts of an organization for effective profit control when he steps over the line of providing service and begins "calling" some of the "shots." The accountant's job, as I see it, is to record, to analyze and to interpret in such a way that members of the line organization may more effectively carry out their responsibilities.

This job is to aid the entire organization through meaningful reports patterned after the lines of responsibility established in the organization. The accountant must, first of all, properly organize his own department so that he can provide these services. Each of his individuals must have a sphere of authority and responsibility and these spheres must be such that the accountant can measure

results against expected performance and thereby hold his own subordinates accountable to him. His organization should aid the line personnel in establishing areas of responsibility within their departments so that meaningful standards or measuring sticks can be established and so that the accountant can report on these areas in a meaningful way to help those responsible to judge results. The accountant aids all who have a direct responsibility to keep their fingers on or control an activity.

A few suggestions as to the basic rules the accountant should follow in issuing reports to other members of the organization for the above purpose is in order at this point. In the first place, the management-by-exception rule should govern. If proper standards, budgets, or forecasts have been established, the only items or major interest are those for which results have varied materially from that which was anticipated. If a job has been performed in the manner expected, the accountant has submitted enough information when he has reported this to the interested party or parties. There is no reason to take the time or effort or to burden the one responsible with detail on things which have gone in accordance with the plan. Let us spend our time telling our fellow workers what has been better than expected and what has not been as good as expected.

In the second place, our reports should be designed in such a way as to supply analysis of variances so that the person responsible is in a position to take action. It is not enough for a plant manager to know that his actual labor cost is ten per cent more than standard. He must know, in addition, where the increase occurred and, in nearly all instances, there should be some indication as to why. Normally, he is then in a position to correct the situation.

In the third place, all of us mislead those not trained in accounting when we carry percentages or ratios out several decimal places and when we publish income statements carried out to cents. Our art is not as precise or exact as that and I think we mislead people when, in one way or another, there is an inference that it is. In our own organizations, nearly all internal income statements are issued showing only thousands of dollars.

Applied Organization in American Steel Foundries

So far we have dealt rather largely in theory. Now we will bring some of this theory down out of the air a bit by describing some of the things we believe we have accomplished in our company. In order to make my points clearly, it is necessary to give you a brief picture of operations. In our fiscal year ended September 30, 1957 we had sales of $122,600,000, and earnings of $8,000,000. At the year end, we had net worth of $76,000,000 and total assets of approximately $94,700,000. We are engaged primarily in the capital goods heavy equip-

ment field. Today, approximately sixty per cent of our business is with the railroad industry, consisting of component parts for freight cars, passenger cars and locomotives. The remainder of our sales consist of machine tools, hydraulic machinery, roller chains, and steel castings and forgings for industrial and other uses. For the manufacture and sale of these products, we have a parent company and five subsidiary companies. The parent company is divided into three operating divisions which, for all practical purposes, fit into the organization as if they were separate entities. The consolidated group comprises 26 plants in 14 states and two provinces of Canada. We have stock interests in companies in Australia, Mexico and Brazil and have royalty and know-how agreements with firms in various foreign countries.

It can be seen from this that organization for profit control is very important to us. Briefly, our organization is as follows. The president has reporting to him two line vice presidents and the presidents of three subsidiary companies. In addition, the director of personnel and public relations and the vice president-finance report to him. Each of the operating divisions has a general manager who is responsible for the profit performance of his division. He reports to one of the two line vice presidents. The presidents of two of the subsidiaries also each reports to a line vice president. The line vice presidents and the presidents of the subsidiaries reporting to our president are responsible for profit control in the areas in which they have jurisdiction. In other words, the general manager of a division is responsible for the profit performance of his division and, in turn, a line vice president is responsible for the profit performance of each of the divisions or companies reporting to him. Each of the divisions and subsidiaries has its own sales manager, engineering manager, manufacturing manager and controller. In short, it is a self-contained unit.

It is appropriate here to particularize the accounting (and legal) organization. The financial vice president has three individuals reporting to him: the secretary and counsel, the treasurer and controller. In the accounting department there are two assistant controllers, the chief of the internal audit section and a confidential assistant reporting to the controller. The controller's delegation of responsibilities is to these individuals. For the most part, the assistant controllers further delegate their responsibilities to their various section heads. One assistant controller is in charge of what is normally considered financial accounting and the other is responsible for the area usually thought of as plant or cost accounting. The controllers of the subsidiaries and divisions report to the controller on a functional basis. They do not work directly for him. The internal audit section for the entire group of companies is within our department and works directly for the controller. The audit activity extends beyond the accounting functions

into other phases of the company's business. In these arrangements, we believe that we have followed the theories set forth in earlier paragraphs in establishing responsibilities within the controller's department in such a way that each individual may be held responsible for a rather clear-cut line of duties.

A Four-Year Accounting Training Program

At the beginning of this paper we indicated that, when we consider organization, we are talking about people. They, not methods and procedures, make the wheels go around. For that reason, the program we have followed for many years in our accounting department to develop a strong corps of supervisors is pertinent here. To achieve this objective we rotate people in jobs considerably below the section head level. This usually places us in a position of having two or more individuals who can be considered for any job opening at the section head level. Twenty-one years ago, however, it was realized that we had to find some method of bringing new, qualified people into the organization and teach them something about the over-all business. At that time, we inaugurated our accounting training program for college graduates. Under it an individual who has majored in accounting is put through a four-year training program. About three years of this program are spent at various plant sites. The final year is spent in the general office. At some time during this training period, an individual is exposed to each of the accounting functions but, perhaps more important, he is schooled in operations, purchasing activities, financial activities and sales activities. The program is formal. Outlines covering the work to be performed are furnished the trainee. Throughout he is assigned to accounting functions of one kind or another. He is also given time to observe and study operations and spends time working in the other areas already noted.

At the time the individual has completed the training program, he has a reasonably good picture of our business, its problems and its opportunities. At that point, however, he has had no actual supervisory experience and the first assignment after completion of the program is usually that of being "No. 2 man" in a plant accounting organization. We hope that, through his training program, he has learned to work in a relatively large organization and has learned to get along with people within the organization. On his first job assignment, we hope that he learns to become a good supervisor.

Our program is tailor-made for our company. We believe we have had a great deal of success with it. The top accounting jobs in three of our subsidiaries are held by former members of the training program. Organization for profit control depends upon people, and we who are interested in accounting must have properly qualified people at the proper time if we are to perform effectively.

A Practical Method for Applying Current-Value Depreciation

by MAURICE E. PELOUBET

BY THIS TIME MOST BUSINESSMEN know that depreciation allowances are inadequate and they are beginning to realize why. It is not necessary to present elaborate arguments or detailed statistics to prove the loss in value which the dollar has suffered, say, since the year 1940. However, although there has been a great deal written and spoken on this subject, these discussions generally stop just before they get to the point of describing a practical, workable method for recognizing the loss in value of the dollar in the accounts.

It is easy to sympathize with the fears of businessmen, tax administrators and accountants when they think that proper recognition in the accounts of this condition will involve additional appraisals, write-ups, projections and estimates, and will require that financial statements cast loose from their comfortable moorings of completed transactions and positive facts. Nevertheless, the problem is with us and must be solved if industry is to be saved from a continuing and disastrous erosion of capital. Great objections have been made to a graduated corporate income tax. Such a graduation is generally based on earnings or invested capital. The arguments against this have been made many times and are all sound and persuasive.

But it seems to escape notice that we have at the present time an invisibly graduated corporate income tax which is graduated against the owner of depreciable property. A business with a heavy investment in fixed property, say, three-quarters of its net worth, generally is allowed depreciation which is from 50 per cent to 60 per cent adequate. As a result of this, such an enterprise pays out as tax between 75 per cent to 80 per cent on its true net income. A taxpayer which does not require the use of fixed property, such as a service company or a financial institution, pays in current dollars at 52 per cent. This type of graduation hurts a small business more severely than a large corporation because the small corporation will have more difficulty in obtaining funds to pay the tax and to maintain its plant and equipment.

The purpose of this article is not primarily to state the problem or to empha-

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MAURICE E. PELOUBET *(NEW YORK CHAPTER 1929)*, is partner in the firm of Pogson, Peloubet & Co., and has been associated with this firm since 1921. Prior to this he was employed by Price Waterhouse & Co., New York and London offices. Mr. Peloubet has performed many special functions for the accounting profession and the nation. Mr. Peloubet is the author of "Audit Working Papers" and is a previous contributor to the *Bulletin*.

METHOD OF MAINTAINING FIXED ASSET ACCOUNTS AT ORIGINAL INVESTMENT AND CHARGING TO INCOME EXPENDITURES TO MAINTAIN INVESTMENT TO OPERATIONS

	Historical cost			Present value			Book entry for additions		Book entry for reserve for current-value depreciation		Book entry for disreatisements		
	Sales and disreatisements	Additions	U. S. Dept. of Commerce con-struction cost Index (reciprocal)	Sales and disreatisements	Additions	Excess of present value of sales and disreatisements over additions carry forward to next year	Dr. Plant and equipment	Cr. Vendor	Dr. Profit and loss	Cr. Reserve for current-value depreci-ation	Dr. Reserve for depreciation	Dr. Loss on sales and disreatisements	Cr. Plant and equipment
1927	$ 25,000	$	232	$ 58,750	$	YEAR 1950	$	$	$	$	$ 25,000	$ --	$ 25,000
1932	60,000		234	187,200							60,000	--	60,000
1934	75,000		259	194,250							75,000	--	75,000
1937	40,000		232	92,800							32,000	8,000	40,000
1942	25,000		194	48,500							13,750	11,250	25,000
1947	15,000		188	19,200							4,500	10,500	15,000
1952		530,000	100		530,000		530,000	530,000	270,000	270,000			
	$ 260,000	$ 530,000		$ 600,700	$ 530,000	$ 70,700	530,000	530,000	270,000	270,000	210,250	29,750	260,000
						YEAR 1951							
1927	$ 5,000	$	241	$ 12,050	$								
1932	20,000		236	81,200							9,000	--	5,000
1938	20,000		235	47,000							20,000	--	20,000
1943	10,000		186	18,800							16,000	4,000	20,000
1948	5,000		117	5,850							5,500	4,500	10,000
1953		140,000	100		140,000		140,000	140,000	80,000	80,000	1,500	3,500	5,000
	$ 60,000	$ 140,000		$ 165,100	$ 140,000	$ 5,100	140,000	140,000	80,000	80,000	48,000	12,000	60,000
						YEAR 1954							
1935	$ 75,000	$	239	$ 179,250	$								
1938	60,000		241	192,800							75,000	--	75,000
1934	40,000		252	100,800							60,000	--	60,000
1939	20,000		238	47,600							40,000	--	40,000
1944	10,000		189	18,900							16,000	4,000	20,000
1949	5,000		118	5,900							5,500	4,500	10,000
1954		570,000	100		570,000		570,000	570,000	340,000	340,000	1,500	3,500	5,000
	$ 230,000	$ 570,000		$ 545,250	$ 570,000	$ 24,750*	570,000	570,000	340,000	340,000	218,000	12,000	230,000
						YEAR 1955							
1939	$ 45,000	$	241	$ 108,450	$	$					43,000	--	43,000
1950	5,000		117	5,850							1,500	3,500	5,000
1955		250,000	100		250,000		250,000	250,000	200,000	200,000			
	$ 50,000	$ 250,000		$ 114,300	$ 250,000	135,700*					46,500	3,500	50,000
Carried forward from 1952 and 1953, less amount absorbed in 1954						31,050							
Addition at present value added to plant and equipment						84,650*			84,650*	84,650*			
						$ 84,650	250,000	250,000	115,350	115,350			
							$ 1,490,000	$ 1,490,000	$ 905,350	$ 905,350	$ 343,750	$ 57,250	$ 600,000

* Denotes deduction.

EXHIBIT 1

size its importance. What is being attempted here is to describe and illustrate a practical method for recognizing the difference between current-value depreciation and historical cost depreciation, a method which, it is believed, will give substantially the same results as writing off current-value depreciation annually. The proposed method will not charge to taxable income in each year the correct current-value depreciation for that year, but it will charge current-value depreciation to income in total when the depreciable property is scrapped, sold, or otherwise disposed of. We might say that it has the effect of allowing current-value depreciation in arrears, recognizing an unavoidable lag in the writing off of current-value depreciation. This lag will be an amount equal to the difference between depreciation on historical cost and current-value depreciation on property still in use, for, if current-value depreciation is not recognized year by year, the accumulated current-value depreciation cannot be recognized until the property is retired or otherwise disposed of.

How the Method Works

Under the proposed method, there would be written off, at the time depreciable property was dismantled, the difference between the dollars representing current purchasing power and the dollars representing purchasing power at the time the property was acquired. For example, if property worth $100,000 were purchased ten years ago and the present purchasing power of the dollar was 40 per cent of its value at the time of acquisition, then, if $250,000 were invested in depreciable property in the year of dismantlement, $150,000 would be written off immediately and $100,000 would be retained in the property account and depreciated at the usual rates.

If the management had been able, at the time of the purchase of the $100,000 property, to foresee the decline in the value of the dollar and had provided for it year by year, the result would have been a provision equivalent to $150,000 additional purchasing power at the end of the ten year life of the $100,000 asset. It is impossible to estimate such provisions exactly and great difficulties are encountered in making such provisions, even approximately. However, at the end of the life of the asset, the necessary information is available, that is, original cost, the date the property was disposed of, and an index showing the change in value of the dollar between the two dates. With these figures, it is not difficult to calculate a current purchasing power equivalent to the purchasing power of the original investment and the accumulated current-value depreciation can, therefore, be calculated and written off in the year of reinvestment, as indicated above, in arrears.

It is important to understand that the proposed method does not deal with

and is not dependent on any sort of physical replacement of property. No attempt is made, or should be made, to relate the reinvestment to the original cost of the property dismantled, either as a similar piece of machinery or as an equivalent in capacity. The method provides only for the recovery of the cost of the property dismantled. The cost which is being recovered is the current cost in purchasing power, regardless of how this recovered cost is spent, provided only that it *is* spent and that it is spent for depreciable property. It is most exceptional for any type of machinery or equipment to be replaced with something exactly, or even approximately, the same and any method of recognizing current-value depreciation which depended in any way on this type of replacement would immediately be found to be unworkable.

Although the method proposed departs in some respects from a complete theoretical recognition of the declining value of the dollar, principally because of the time lag which is inherent in the method, it does provide a means of recognizing current-value depreciation which will approximate, after the method has been in existence for a few years, the true current-value depreciation, and it will do this without requiring any departures from cost of one kind or another, nor will it require any estimates of asset values or projections into the future, which, under a complete recognition of current-value depreciation, would be necessary. It is also true that all entries under this method will be based on actual completed transactions, as is shown by the attached illustration of method of maintaining fixed asset accounts at original investment and charging expenditures to maintain investment to operations. (Exhibit 1.)

It will be observed that, in years in which reinvestment is less than dismantlements, the difference is carried forward to apply against reinvestment of a subsequent year. There are many possible variations of this method. For example, the initial write-off to compensate for current-value depreciation in arrears might be spread over several years. Some modifications of this method would be necessary where a composite or group method of depreciation was used; but it is believed that the method can be adapted to any recognized type of depreciation accounting.

Two Problems Interwoven

The method described and the entries shown on the exhibit illustrate what is essentially a taxation method. It will provide tax-free dollars for reinvestment in depreciable property as and when these are needed. It will not put funds in the hands of the taxpayer before he is ready to use them for reinvestment in depreciable property. It is not an accounting method for distributing the current value depreciation over the years to which it applies, but there are

already in existence several methods by which this may be accomplished. Current value depreciation may be deducted in the accounts from year to year and the corresponding reserve adjusted when retirements are made and reinvestment take place, or accounts may continue to be kept on an original cost basis with appropriate parallel or supplementary information on a current value basis.

In any event, we are dealing with two separate problems: first, the financial and taxation problems which are closely interrelated, that is, how to make sure that tax-free dollars are available for reinvestment when needed, which will be accomplished by the proposed plan outlined in this paper. Second, we have the accounting and presentation problem. So far as the actual accounts are concerned, it is necessary, as a basic record, to keep accounts on historical cost. It would also be necessary to keep memorandum accounts, at least, as shown in the exhibit to correspond with the tax requirements under the proposed plan.

Where the current value figures are to be shown in the accounts or as supplementary information, property accounts should be kept on a current dollar basis. From accounts such as these, statements for stockholders or any other interested parties can be prepared which would indicate the difference between historical cost and current value, and could also show the effects of the proposed plan for arriving at taxable income.

The proposed method would provide a practical means to end the present unintended discrimination against the owners of long-term facilities and to put all taxpayers on an equal basis. It is fair to all industry, as it is universally applicable and corrects the existing discrimination against the users of long-lived property.

(*Continued from page* 12)

based on the laws of chance. The probabilities or "odds" are an integral part of any statement regarding the sample accuracy. The particular range of value extending equidistantly on either side of the sample estimate will actually contain the true value. These odds or probabilities increase as the precision range increases but not proportionately. Several mathematicians have developed probability tables which extend the precision. For instance, one (see table excerpt below) has established the implication of accepting data based on the number of errors disclosed by test checking.

Assume that 200 items were test checked and that only one error was found. The auditor would probably conclude from the test that the recording was sufficiently accurate to accept. This would be basing the acceptance on "experience," as he would determine that, in this case, the sampling indicated an error factor of one half per cent. Poisson's distribution table would show a further factor based on scientific computation. A portion of the table is as follows:

Items tested	Errors found	Number of times in 100 the error rate is less than:		
		½%	1%	2%
200	0	63	86	98
200	1	26	59	91
200	2	8	32	76

If the 200 items checked disclosed two errors, or one per cent, this would indicate that the accountant would be right 59 per cent of the time and wrong 41 per cent of the time in assuming that the error rate was one per cent. At this point, he should decide whether he should make any further testing. The technique has four major advantages. First, it is based on elementary concepts and an extensive study of statistics is not necessary. Second, no involved formulas or calculations are required. Third, the sample plan retains the desirable feature of the sequential sample, even on very small samples. Fourth, the method does not require any change in the present test-checking techniques.

With the limits of precision defined, and enumerated as above, the auditor is in a better position to determine whether his sampling is acceptable, unacceptable, or indecisive and can thus increase his confidence in the results. The auditor reduces his decisions to evaluation of two positive considerations: what is the maximum rate of error that is acceptable in any given situation, and what further assurance do I desire to base my conclusion on the results of the statistical samples and the maximum allowable rate of error? Statistics are an essential tool to be used by the auditor to enable him to make his decisions based on the standards he has set. He must determine the risk that he is willing to assume for erroneous decision in accepting the data or, conversely, the greater percentage of times that he is certain of reaching a correct conclusion.

Learning How to Use the Learning Curve

by RAYMOND B. JORDAN

THE LEARNING CURVE has now become an accepted tool in industry for projecting shop loads, determining manpower requirement and negotiating subcontracts. The armed forces, especially the Air Force, now use the technique to determine the reasonableness of quotations from prime contractors. It is used to measure some or all of the following results:

1. Improved proficiency of the operator as production increases.
2. Reductions in manufacturing losses.
3. Stabilization of design resulting in fewer design changes.
4. Increases in lot sizes.
5. Improvement in special tooling.
6. An adequate cost reduction and value analysis program.
7. Changing from a daywork to a piecework system.
8. Changing from manual to automatic machinery as production warrants.

The theory of the learning curve is that, whenever the total quantity of units produced doubles, the cumulative average cost per unit declines by a constant percentage.

In the various illustrations in this text, the 90 per cent learning curve is used only because it more nearly approximates the experience expected from the type of manufacture in which the writer is engaged. The air frame manufacturers, who were the pioneers in the development of the learning theory, have experienced an 80 per cent curve, i.e., a 60 per cent ratio between the cost of the block increase (100% increase in production) and the previous cumulative average. This is a 40% reduction between blocks. Such a large reduction has been brought about principally due to the large volume of assembly operations in an airplane where learning is limited only by the dexterity of the human hand. In the manufacture of products composed principally of machine operations, much of the reduction in cost is limited by the feed and speed of the machine. In fact, in connection with automatic machinery, no learning can be expected other than from improved machinery, design changes or cost reduction programs. In general, learning seems to trend along the following lines:

75% Assembly labor, 25% machine labor	80% Curve
50% Assembly labor, 50% machine labor	85% Curve
25% Assembly labor, 75% machine labor	90% Curve

RAYMOND B. JORDAN, *MASS. NORTH SHORE CHAPTER (CINCINNATI 1949)*, is Manager—Cost Accounting, General Electric Company's Aircraft Gas Turbine Division, Small Aircraft Engine Department, West Lynn, Massachusetts.

ILLUSTRATION OF 90% LEARNING CURVE

Cumulative Production	Cum. Aver. Hours per Unit	Ratio To Prev. Cum. Aver.	Cumulative Production	Cum. Aver. Hours per Unit	Ratio To Prev. Cum. Aver.
1	100.0 Hours	--	16	65.6 Hours	90%
2	90.0 "	90%	32	59.0 "	90%
4	81.0 Hours	90%	64	53.1 "	90%
8	72.9 "	90%	128	47.8 "	90%

EXHIBIT 1

The principal factor which determines the accuracy of these percentages in any particular instance, is the thoroughness with which a new job is developed and tooled before production is started in the shop. The learning curve can be usefully applied to a new line of apparatus or a line which has been in operation only a few months and on which complete cost data is available. It cannot helpfully be applied to products which have been mass produced for a number of years and can be assumed to have reached that point on the learning curve where the difference in cost between successive units approaches zero. It may be applied to new products which represent old products with specific design changes, but it will first be necessary to determine the point on the learning curve which applies to both products.

Calculation and Charting of Learning

Exhibit 1 is a simple illustration of a 90 per cent learning curve in data form. Note that as the quantity doubles, the new cumulative average hours per unit are 90 per cent of the previous cumulative average hours. Hours have been used as a basis for this simple illustration, but factory cost or selling price will apply equally as well. On the graph, shown in Exhibit 2, the cumulative average hours per unit are plotted on the vertical axis and the cumulative units

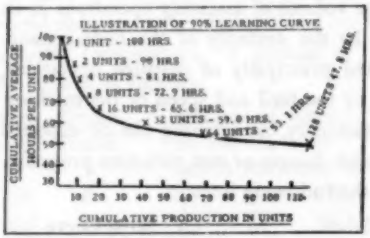


ILLUSTRATION OF 90% LEARNING CURVE
1 UNIT - 100 HRS.
2 UNITS - 90 HRS
4 UNITS - 81 HRS.
8 UNITS - 72.9 HRS.
16 UNITS - 65.6 HRS.
32 UNITS - 59.0 HRS.
64 UNITS - 53.1 HRS.
128 UNITS 47.8 HRS.
CUMULATIVE AVERAGE HOURS PER UNIT
CUMULATIVE PRODUCTION IN UNITS

EXHIBIT 2

RELATIONSHIP BETWEEN
100% BLOCK INCREASE
PREVIOUS CUMULATIVE AVERAGE

Learning Per Cent	Ratio of 100% Block Increase	Learning Per Cent	Ratio 100% Block Increase
95%	90%	70%	40%
90	80	65	30
85	70	60	20
80	60	55	10
75	50	50	0

EXHIBIT 3

produced are shown on the horizontal axis. Note that the decline in average hours is fairly rapid at first but, as the quantity continues to double, the difference in hours between successive units becomes even smaller until it eventually

approaches zero. Can we tell just how fast cost decline takes place whenever production doubles? Using the illustrated data, the calculation is as follows:

2 units @ 90 hours cumulative average	180 total hours
Subtract 1 unit @ 100 hours	100
Hours required to produce second unit	80

This leads to the conclusion that, in a 90 per cent learning curve, whenever production of a unit is doubled, the average value of the additional block (or 100 per cent increase in production) is 80 per cent of the previous cumulative average. Exhibit 3 shows this relationship for other learning curves. As can be seen a 50 per cent learning curve would require making the next block for no expenditure of time. In general, a learning curve below 70 per cent is impractical. In the other direction, a learning per cent of 100 would indicate no learning at all, while a per cent in excess of 100 would indicate that costs were increasing. In all cases, the curve tends to level as the difference in cost between successive units approaches zero. This point may be illustrated by determining the average reduction in hours per additional block of units and dividing it by the number of units in the block. Exhibit 4, for example, shows that, when production doubles from 64 units to 128 units, the average difference per unit for the increase of 64 units is .07 hours. Exhibit 5 depicts the information shown in Exhibit 2 but does so by use of log-log coordinates similar to the measurements on the C and D scales of an ordinary slide rule. Plotting of the learning data upon log-log paper results in a straight line, an advantage in computing the curves.

DIFFERENCE IN HOURS PER UNIT - 90% LEARNING

Cumulative Production	Cumulative Average Hours	Quantity	Per Block Average Per Unit	Average Difference Per Block	Average Difference Per Unit
1	100.0 Hours	1	100.0 Hours	--	--
2	90.0 "	1	80.0 "	20.0 Hours	20.00 Hours
4	81.0 "	2	72.0 "	8.0 "	4.00 "
8	72.9 "	4	64.8 "	7.2 "	1.80 "
16	65.6 "	8	58.3 "	6.5 "	0.81 "
32	59.0 "	16	52.4 "	5.9 "	0.37 "
64	53.1 "	32	47.2 "	5.2 "	0.16 "
128	47.8 "	64	42.5 "	4.7 "	0.07 "

EXHIBIT 4

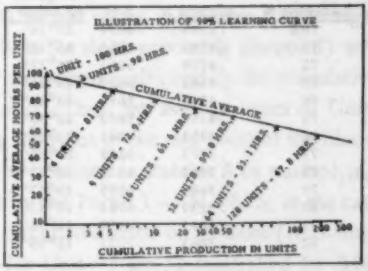


ILLUSTRATION OF 90% LEARNING CURVE
1 UNIT - 100 HRS.
2 UNITS - 90 HRS.
CUMULATIVE AVERAGE
4 UNITS - 81 HRS.
8 UNITS - 72.9 HRS.
16 UNITS - 65.6 HRS.
32 UNITS - 59.0 HRS.
64 UNITS - 53.1 HRS.
128 UNITS - 47.8 HRS.
CUMULATIVE AVERAGE HOURS PER UNIT
CUMULATIVE PRODUCTION IN UNITS

EXHIBIT 5

MATHEMATICAL REPRESENTATION OF LEARNING CURVE PATH

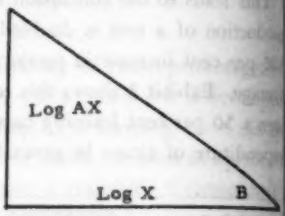
$$AX = KX^{-N}$$ where

AX = the cumulative average hours (or some other measurement for a series of X units of production

K = the value of unit number one

N = the slope of the log-log learning curve line or tangent of angle B.

The triangle to the right represents a learning curve series with B being the angle the learning curve makes with the horizontal axis. As previously stated, as X doubles in a 90% curve values for AX become 90% of the previous value of AX.



The slope of any straight line represents the value of the tangent of the angle the line makes with a horizontal axis. From trigonometry, the tangent of an angle is the ratio of the side opposite the angle to the side adjacent. Thus:

$$\text{Tangent Angle B} = \frac{\log AX}{\log X}$$

This represents the constant relationship between cumulative average hours and cumulative production in a learning curve series. This relationship can be useful in charting because, by use of a protractor, the log-log learning curve line can be drawn. The values for N or slope will always be negative since AX decreases while X increases.

EXHIBIT 6

EQUIVALENT SLOPES AND FACTORS FOR LAST UNIT

Learning %	SLOPE N	1-N	Degrees of Angle	Learning %	SLOPE N	1-N	Degrees of Angle
70%	.5146	.4854	27°14'	83	.2688	.7312	15° 3'
71	.4942	.5058	26°18'	84	.2516	.7484	14° 7'
72	.4739	.5261	25°22'	85	.2345	.7655	13°12'
73	.4541	.5459	24°24'	86	.2176	.7824	12°17'
74	.4345	.5655	23°29'	87	.2009	.7991	11°22'
75	.4150	.5850	22°32'	88	.1845	.8155	10°27'
76	.3959	.6041	21°36'	89	.1681	.8319	9°33'
77	.3771	.6229	20°39'	90	.1520	.8480	8°39'
78	.3585	.6415	19°43'	91	.1361	.8639	7°45'
79	.3401	.6599	18°47'	92	.1204	.8796	6°52'
80	.3219	.6781	17°51'	93	.1047	.8953	5°59'
81	.3041	.6959	16°55'	94	.0892	.9108	5° 6'
82	.2863	.7137	15°59'	95	.0740	.9260	4°14'

EXHIBIT 7

The path of the learning curve is that of a geometric series or progression in which each point is determined by multiplying the previous point by a constant factor. In the case of the 90 per cent curve in Exhibit 5, each point representing the cumulative production in units has been obtained by doubling the previous cumulative production. In like manner, each point representing the cumulative average hours is 90 per cent of the previous cumulative average. Algebraically, this geometric progression has evolved into the formula shown in Exhibit 6 and its trigonometric expression is also shown there. The values for N (and of 1 — N) for all curves from 70 per cent to 95 per cent have been determined and are shown in Exhibit 7. The degree of angle for each of the curves for use in plotting is also shown.

To determine the average hours for any block of a particular product requires a little mathematics. For example, we could find the average value of Units 51-100 in Exhibit 8 by placing a ruler on the graph at units 50 and 100 and reading from the chart that the average hours for 50 units are 55.0 hours and the average hours for 100 units are 49.5 hours. Then:

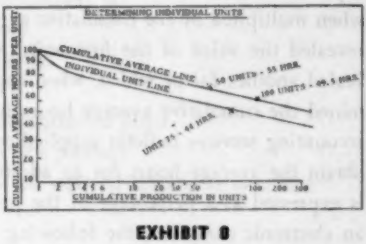

DETERMINING INDIVIDUAL UNITS
CUMULATIVE AVERAGE LINE
INDIVIDUAL UNIT LINE
50 UNITS - 55 HRS.
100 UNITS - 49.5 HRS.
UNIT 75 - 52 HRS.
CUMULATIVE AVERAGE HOURS PER UNIT
CUMULATIVE PRODUCTION IN UNITS

EXHIBIT 8

100 units @ 49.5 hours	4950	
50 units @ 55.0 hours	2750	
Difference	2200	Total hours of units 51-100

$$\text{Average } \frac{2200}{50} = 44$$ Average hours of units 51-100

Reading points on a log-log chart sometimes becomes difficult, especially if the numbers are large. In order to facilitate the determination of the average hours of a block of units such as Units 51 to 100 above, it has been proven algebraically that the Factor 1 — N (where N is the slope previously discussed) will determine the approximate hours of any unit when multiplied by the cumulative average hours of the same number of units. Thus, the average hours of Units 51 to 100 can be obtained by determining the value of the mid point of the block, or unit 75. The hours of Unit 75 may be obtained in Exhibit 8 by multiplying the cumulative average hours of 75 units by the Factor 1 — N which, in the case of 90 per cent curve, is .848. Thus, the cumulative hours of 75 units (read from the chart) are 52 hours and the hours for Unit 75 are 52 multiplied by .848. Hence, 44 becomes the approximate average hours of Units 51 to 100. This

will not represent the most accurate calculation since, in a geometric progression, the mid point does not represent the mathematically accurate value for the block. Depending upon the end use for which the information is desired, however, the mid-point will probably be adequate.

The use of the factor 1 — N has also been availed of in Exhibit 8 to determine several points from which to draw an individual unit line. Thus the hours for Unit 75 in the foregoing example can be read from the chart rather than computed mathematically. However, the factor 1 — N applies from Unit 4 on only. As can be seen from the chart, the individual unit line is not parallel to the cumulative average line for Units 2 or 3.

In experimenting with the learning curve equation it was found that, by taking any value of X and raising it to the Nth power, a factor was obtained which, when multiplied by the cumulative average hours for the same number of units, revealed the value of the first unit. Similarly, the reciprocal of this factor revealed another factor which, when applied to the value of the first unit, determined the cumulative average hours for X units. A General Electric Company accounting services bulletin supplied another formula for determining factors to obtain the average hours for an additional quantity of units when the quantity is expressed as a percentage of the previous cumulative quantity. By means of an electronic computer, the following factors have been derived:

1. Factors to determine hours for the first unit when the cumulative average is known.
2. Factors to determine cumulative average hours when first unit is known.
3. Factors to determine average hours for an additional quantity.

With these factors and a desk calculator, countless calculations can be made in a short time, rather than resorting to the use of charts. Opinion seems to be divided as to which method is best. It has been found from experience that it is sometimes impossible to read points on log-log charts with any degree of accuracy. On the other hand, the mathematical factors imply a high degree of accuracy which probably does not exist. The use of both charts and mathematical factors is recommended, with one complementing the other.

MATHEMATICAL FACTORS 90% LEARNING CURVE

Qty.	AX	K	Per Cent Additional	Factor	Qty.	AX	K	Per Cent Additional	Factor
50	.5518	1.8122	25%	.8333	350	.4105	2.4358	175%	.7763
100	.4966	2.0135	50	.8207	400	.4023	2.4858	200	.7691
150	.4670	2.1413	75	.8098	450	.3952	2.5307	225	.7631
200	.4470	2.2372	100	.8000	500	.3889	2.5715	250	.7573
250	.4321	2.3144	125	.7913	550	.3833	2.6090	275	.7518
300	.4203	2.3794	150	.7833	600	.3783	2.6438	300	.7467

EXHIBIT 9

Exhibit 9 shows some of the factors for a 90 per cent curve. Factors have been determined for AX and K up to 10,000 units and values for P up to 1000 per cent for all learning curves from 70 per cent to 95 per cent. The use of log-log paper and mathematical factors makes learning calculations easy. Knowledge of one point on the curve and the learning per cent is sufficient information to determine the values of all units in blocks or cumulatively up to 10,000 units.

Applications of the Learning Theory

The application of the learning theory is almost unlimited. A few industrial applications now in use are as follows:

1. Setting selling prices for future production.
2. Projecting labor loads in the factory.
3. Determining manpower requirements.
4. Control of shop labor.
5. Determining realistic prices for subcontracted items.
6. Estimating starting load costs of a new product.
7. Examination of training progress of new employees to eliminate incompetent workers.
8. Make-or buy decisions.

Application to Setting of Selling Prices

Consider the case in which the contract includes 400 units at an average price of $75,000 per unit, with retroactive redetermination at the end of the first one hundred units shipped. Exhibit 10 provides information of calculation of upward redetermination which will take place following the shipment of the 100th unit. Using the factors from Exhibit 9, the theoretical value of Unit 1 is $75,000 times 2.4858 or $186,435. The first 100 units should each have a value of $92,584, which is obtained by multiplying 186,435 by the factor for the cumulative average value for 100 units (.4966). Thus:

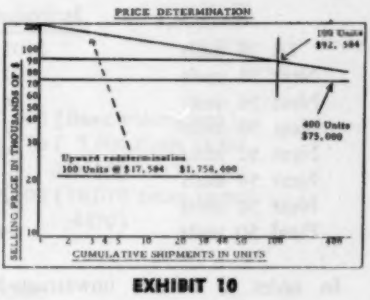

PRICE DETERMINATION
100 Units $92,584
400 Units $75,000
Upward redetermination 100 Units @ $17,584 $1,756,400
SELLING PRICE IN THOUSANDS OF $
CUMULATIVE SHIPMENTS IN UNITS

EXHIBIT 10

Learning curve value	$92,584
Contract price	75,000
Upward redetermination 100 units @	$17,584 or $1,758,400

This represents upward redetermination of approximately 23.5 per cent which would place the contractor in an unfavorable position. He can reduce redetermination problems to a minimum by use of the learning curve. In this case, it is recommended that the contract be split into blocks of 50 engines each. The value of unit one has already been determined ($186,435). From the tables:

	Cumulative Unit	Cumulative Average Value
$186,435 times .5518	50	$102,875
186,435 times .4966	100	92,584
186,435 times .4670	150	87,065
186,435 times .4470	200	83,336
186,435 times .4321	250	80,559
186,435 times .4203	300	78,359
186,435 times .4105	350	76,532
186,435 times .4023	400	75,000

The value of each block is then obtained by use of a desk calculator as follows:

1st 50 units	$ 102,875
100 units @ 92,584	9,258,400
50 units @ 102,875	5,143,750
Total value of Units 11-100	4,114,650
$\frac{4,114,650}{50}$	$ 82,293

By following the above method through each block, the quotation would be as follows:

	Individual blocks	Cumulative average Units	Price
1st 50 units	$102,875	50	$102,875
Next 50 units	82,293	100	92,584
Next 50 units	76,027	150	87,065
Next 50 units	72,149	200	83,336
Next 50 units	69,451	250	80,559
Next 50 units	67,359	300	78,359
Next 50 units	65,570	350	76,532
Final 50 units	64,276	400	75,000

In order to remove unwarranted implication of extreme mathematical accuracy, it would be advisable to round off all figures to the nearest five dollars.

Let us take another example. A major design change often poses a problem in negotiating prices. Consider the case in which a design change takes place at

the end of 200 units. It will be necessary to determine at this point the value of the parts common to both designs and the value of the parts peculiar only to the design change. In the example in Exhibit 11, the first 200 units of the superseded design had a cumulative average cost of approximately $63,430 which can be read from the chart or computed mathematically as follows:

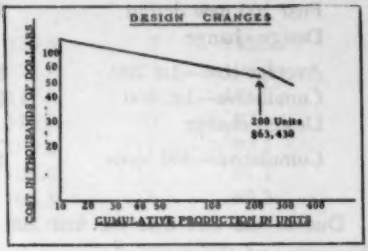


EXHIBIT 11

First 10 units	$100,000 (from the chart)
Value of 1st unit	141,900 (100,000 times factor 1.4190 from Exhibit 9)
200 Unit Average	64,430 (141,900 × factor .4470 from Exhibit 9)

The value of parts common to both designs is $60,000. The first 100 sets of parts common only to the new design are expected to cost $5,000. The required information is the expected cost of first 200 units of the new design.

Common parts		
First 200 units	$ 60,000 (Basic assumption)	
Value of 1st unit	134,230 (60,000 times factor 2.2372)	
Cumulative average—400 units	54,000 (134,230 times factor .4023)	
400 units @ $54,000		21,600,000
200 units @ 60,000		12,000,000
Total cost of next 200 units		9,600,000
Cost per unit		48,000
Design change		
First 100 units	$ 5,000 (Basic assumption)	
Value of 1st unit	10,070 (5,000 times factor 2.0135)	
First 200 units	4,500 (10,070 times factor .4470)	
Summary		
First 200 units of old design	$60,000	
Add cost of 1st unit	10,030	
Approximate cost—1st 200	$70,070 (Beginning point on chart for new design)	

First 200 new design	$48,000	(Common parts only)
Design change	4,500	
Average cost—1st 200	$52,500	
Cumulative—1st 400	$54,000	(Common parts only)
Design change	4,500	
Cumulative—400 units	$58,500	(To establish 2nd point on chart)

Due to the fact that the first 200 sets of design change parts are at the beginning of the curve where cost is decreasing faster than the common parts, the resulting curve is not parallel to the old curve. As production continues to increase, however, the curve will bend until it is again parallel. The chart and computations also indicate that the new design is a cost reduction after liquidation of starting costs. As an alternative, the per cent additional factors may be used in computing the cost of the individual blocks. Thus:

Under old design — previously manufactured —		200 Units
next block of units		200
Ratio		100%

From Exhibit 9, 100% additional factor is 80%
Next block 60,000 times .8 $48,000

Application to Labor Loads and Manpower Requirements

The study of the learning theory has revealed that a certain amount of cost reduction can be expected solely from learning or experience without the need for specific cost reduction projects. When applied to labor loads or manpower requirements when building up a new line of apparatus to capacity, it reveals that increases in production can be expected from experience alone rather than adding people to the payroll. In fact, if the production buildup is slow enough, all of the increases in production could be obtained from reduced costs.

Consider a hypothetical case for which first shipments to customers are to take place in January. If the first 100 units average 100 hours on a 90 per cent curve, Unit one will be 201.35 hours (using the tables in Exhibit 9). The cumulative average hours for each unit to be shipped would first be calculated. (Due to the odd quantities, the factors used in this calculation are not shown in Exhibit 9). Next the individual blocks would be computed. The following table shows these figures:

Cumulative shipments		Factor	Cumulative average hours	Individual blocks Qty.	Individual blocks Average hours
5	201.35 times	.7830	157.7	5	157.7
11		.6946	139.9	6	125.1

(Continued)

18	.6445	129.8	7	113.9
26	.6095	122.7	8	106.7
35	.5826	117.3	9	101.7
45	.5607	112.9	10	97.5
56	.5424	109.2	11	94.1
68	.5266	106.0	12	91.1
81	.5128	103.3	13	89.2
95	.5005	100.8	14	86.3

With a manufacturing cycle of thirteen weeks, the five units to be shipped during the first week of January must be started in the shop during the first week of October. Likewise, the six units to be shipped during the second week of January must be started during the second week of October. Assume that the cost of each unit will be spread evenly over the thirteen week cycle. Thus, labor input for the first week of October would be 5 units @ 157.7, divided by 13 or 60.6. The second week would be:

5 units @ 157.7 divided by 13	60.6
6 units @ 125.1 divided by 13	57.8
Total second week	118.4

Each succeeding week's labor input would be computed in the same manner. Total input hours are then summarized as follows:

Month	Week	Total hours	Month	Week	Total hours	Month	Week	Total hours
Oct.	1	60.6	Nov.	1	315.8	Dec.	1	643.4
	2	118.4		2	390.8		2	736.5
	3	179.7		3	470.5		3	834.0
	4	245.5		4	554.6		4	935.8
							5	1041.8

(Continue on as far into the future as required)

From the previous example, the number of hours required per week have already been determined. Using a forty hour week as normal, the following would be the employee requirements:

Month	Week	Hours req.	Empl.	Month	Week	Hours req.	Empl.
Oct.	1	60.6	2	Nov.	3	470.5	12
	2	118.4	3	(cont'd)	4	554.6	14
	3	179.7	5	Dec.	1	643.4	16
	4	245.4	7		2	736.5	19
Nov.					3	834.0	21
	1	315.8	8		4	935.8	24
	2	390.8	10		5	1041.8	26

(Continue as required)

At the point where the required schedule of 25 units per week has been reached, further progress on the learning curve without an increase in output will necessitate a slight layoff.

Application to Purchasing

One of the most fruitful applications of the learning theory concerns its use in determining the reasonableness of a vendor's quotation on non-standard items on which the vendor has had experience by means of a previous order. Single-source procurement of special fabrications often places the customer at a disadvantage in negotiating prices for orders beyond the initial quantity, since the vendor is aware that the customer, in developing new sources, will face for a second time prices set to absorb starting costs, tools, etc. The ratio of raw material content to selling price will play an important part in selecting the appropriate learning per cent for determining a reasonable price for a repeat order. If possible, the calculation of the price for the next order should be based upon direct labor hours. Once this calculation has been completed, raw materials, labor per hour and overhead can be added at current or anticipated rates.

As an example, suppose that a quantity of 225 pcs. of Part X is required from the PDQ Company. Previous purchase history is confined to a single purchase order for 75 pcs. @ 125 hours each. Part X is principally a machined component with no assembly. We select 90 per cent as the applicable learning per cent. Since the ratio of the new order to the previous order is 300 per cent, we can read from Exhibit 9 that .7467 is the proper factor to apply. This, multiplied by the earlier hours of 125.00 yields of 93.34 hours, as the reasonable time per piece for the next order of 225 pieces. Current or negotiated rates for labor, materials and overhead may now be added.

Measuring Learning

Most of the detail contained in this article is slanted towards the application of the theory of the learning curve through the use of predetermined learning percentages. Those experienced in general by industry have been indicated, but there is no guarantee that there will be any similarity in results between manufacturers, in spite of similarity of product, methods, etc. A company should calculate its own learning experience, should continue to measure results in comparison with estimates, and should be flexible enough to reflect in future applications the results of these frequent measurements.

The measurement of results is performed through the interpretation of the learning theory that "every time production doubles, the new cumulative average

is a percentage of the previous cumulative average." Measurement consists of plotting actual results on log-log paper, then determining two points on the curve, the cumulative quantity represented by one point being double the quantity represented by the other. Dividing the value of one point by the other reveals the learning experience. Exhibit 12 is the plotting of data showing that the first 20 units of Product X required 47.5 hours each, the next 30 35.0, and the next 15 units 32.0. First, we determine the cumulative average for each quantity, in order to draw the cumulative average line, as follows:

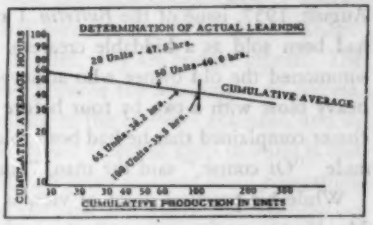


EXHIBIT 12

Cumulative quantity	Cumulative average
20 Units	47.5 Hours
50	40.0
65	38.2

The points representing this cumulative average data, plotted on the chart, do not fall in a straight line, but are "interpreted" by a straight line which passes equidistant from each point. In this instance, to determine learning, read 35.5 hours at 100 units from the chart and divide by 40.0 hours at 50 units to obtain 89 per cent (approximately), as the learning percentage.

Where Do We Go From Here?

This article has attempted to present a most difficult subject in a relatively simple manner. However, the intention has been to offer material sufficient to allow the introduction of the learning theory on a partial basis without the need for further research. But this should require numerous readings, and following through of the mathematical calculations in order to more fully understand the technique. When learning theory is used correctly, it can lead to increased business and higher profits. When used without proper knowledge, it can lead to lost business and bankruptcy. Survey your business and determine where the technique of the learning curve applies. Start now to collect actual cost data, so that some time in the future you can put the technique into operation after you have determined the learning per cent which applies to your business.

COMMANDING ATTENTION by LYNDON H. LaROUCHE, JR.*

IN RESPECT TO A. J. HORTON'S delightful, commendable polemic in the August, 1957, issue of the *Bulletin*, I am reminded of the story of a mule which had been sold as a biddable creature. The new owner, finding him stubborn, summoned the old owner who achieved the animal's obediency by striking it a heavy blow with a two by four before directing it to go to the barn. The purchaser complained that he had been told all he had to do was speak gently to the mule. "Of course," said the man, "but first you have to get his attention."

While his practical point of view is not strange to the pages of the *Bulletin*, Mr. Horton performs important novel service by expressing fundamentals in an aggressive tone. The finest matter-of-fact pedagogy will fail unless the teacher first commands the students' attention. It is not always sufficient to suggest, to point out; it is sometimes necessary to reach for that two-by-four.

To quote from the letter on a technical point . . . "how the variables group themselves and how these groupings tend to behave in response to changes in volume, mix, efficiency and attitudes of personnel . . ." represents the burning issue of small business management. In my opinion, there is no existing statistic which nearly begins to portray the rate of small business failure or near-failure which is really due to a failure on management's part to understand even the rudiments of such accounting techniques. For the lack of such accounting, the typical small business management is unaware of the real, practical nature of its most pressing problems and even more unaware of the proper corrective actions available.

The issue raised by Mr. Horton is not an "ivory-tower" speculation on possible embellishments, by-products, or collateral improvements; it is a basic issue deserving the most energetic support. If polemic, caustic rhetoric, even outright phillipics will somehow drive enough people to get the ball rolling a little faster, by all means let us put aside any professional queasiness and get the Old Donnybrook started.

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* Executive Engineer in charge of Client Services for the Eastern Division of the May Company.

Bringing the Budget to Bear on Operations

by HERBERT T. McANLY

REPORTS USED BY INTERNAL MANAGEMENT in planning and controlling operations and current financing are those reflecting comparisons of operating costs and expenditures with budgets and forecasts for all levels of management of the various operating functions. In brief, they are budget reports. The budget in business is a major contribution towards the attainment of success. But it can be undertaken by degrees, according to the facilities available, and its scope enlarged from time to time. A most impact aspect to keep in mind is that the benefit to be derived from budget control consists in many small economies. Their accumulation becomes greatest when the rank and file of the organization operate under the detail of the budget in its complete form.

Formulating Operating and Cash Forecasts

Exhibit 1 is a simple graphic example of an operating forecast in which are reflected the net profit or loss, the cash profit or loss, and the margin above fixed operating cost at various volumes of activity. In this exhibit, all operating costs have been classified as between items which are considered to vary in relationship to volume and those which are of a fixed character. The items in the variable classification include material, direct labor, and variable manufacturing and variable commercial burden. (Such as certain indirect labor, supplies, social security and workmen's compensation insurance, equipment maintenance, salesmen's commissions). Items in the fixed classification include fixed commercial and manufacturing cash outlay expense (such as executive and supervision salaries, real and personal property taxes, fire insurance, building maintenance, administrative office expense, etc.) and fixed manufacturing and commercial non-cash expense (such as depreciation, amortization).

The budget line (heavy vertical line) relates both the chart and the condensed summary of the forecast appearing at the top of the exhibit to the operating plan chosen. It gives consideration to commitments or contemplated material prices, the current or anticipated wage level, current values of supplies and expense, and contemplated product selling prices. The budget should be so set that it will become an actuality if the contemplated volume is attained and the operating costs are controlled according to the plan. However, regardless of the care exer-

HERBERT T. McANLY *(CLEVELAND CHAPTER 1926)*, is General Partner, Ernst & Ernst, Cleveland, Ohio. He has been associated with this firm for more than thirty-five years, his primary function is the direction of his firm's Management Services throughout the United States. Mr. McAnly has appeared as speaker before conferences of national groups, including N.A.A. He is a past National Director of N.A.A.

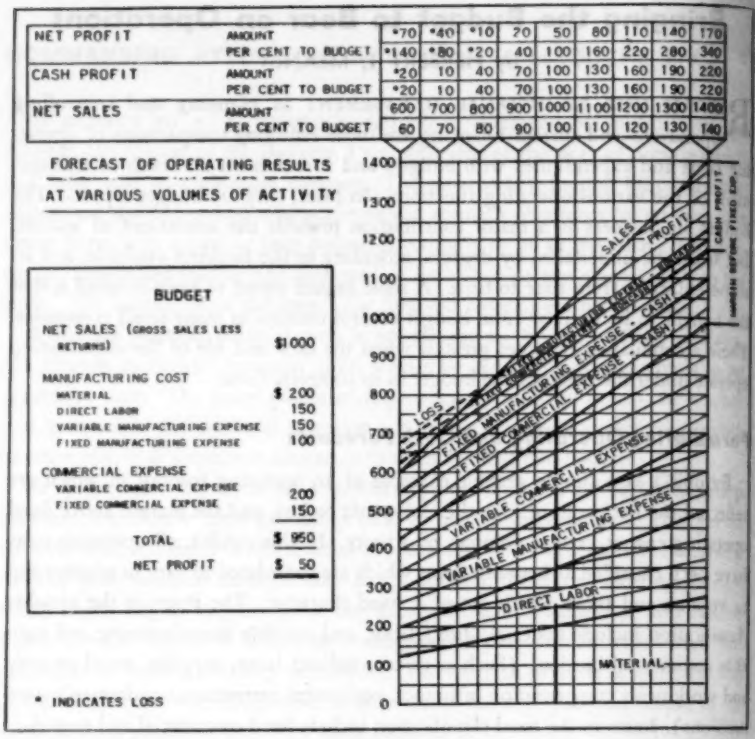


EXHIBIT 1

cised in planning, it is extremely difficult to project, with any great degree of accuracy, the specific volume which may be realized. That is the reason for including in the forecast results for each volume within a reasonable range of the volume contemplated.

If the enterprise covers the manufacture and/or selling of several lines of related products to several classifications of customers through one or more distribution channels, the prime cost (material and direct labor) and variable direct selling cost can be budgeted for each. Other general indirect variable manufacturing and commercial cost can be applied to each classification and the total margin contribution to cover fixed expense and profit determined for each classification. This makes available the margin of contributions of various combinations of volume of the respective product and/or customer classifications. In the development of these over-all or product classification cost ratios, all indirect labor and

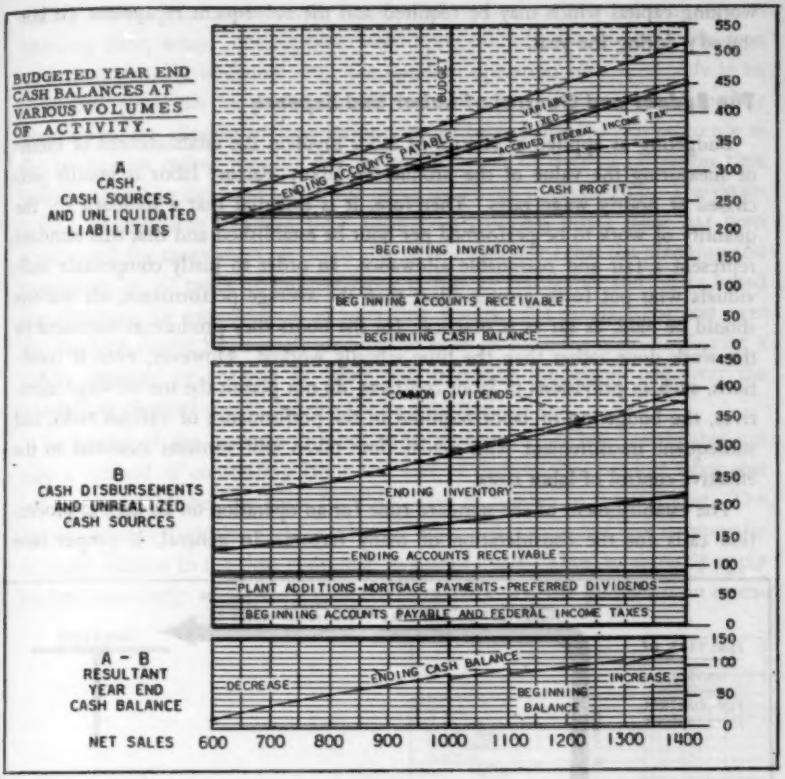


EXHIBIT 2

overtime premiums should be shown separately so that the effect of varying wage levels and work week hours of plant operations can be quickly reflected.

A forecast of the approximate change in cash position and the effect on other items of working capital which will result from operating at each volume amount within a reasonable range of activity sets forth information which is essential in the formation of policies relative to the need for temporary working capital. Exhibit 2 is illustrative and concerns the same enterprise as in Exhibit 1. The portrayal of the year-end cash balance at the bottom of Exhibit 2, which is the difference between the cash available from operations and the cash applied, represents the approximate amount of cash on hand after repayment of any temporary money borrowed during the year. A detailed operating cash forecast will also include cash receipts and disbursements by months, showing the additional

working capital which may be required and the subsequent repayment (if borrowed) during the year.

The Budget and Control of Labor and Expense

Budgeting as applied to control of labor involves the establishment of means of measuring the value of the product of labor. Factory labor is usually purchased at hourly wage rates. Therefore, it is essential that a standard for the quantity of work to be performed per hour be established and that this standard represent a fair and reasonable allowance. In order to justly compensate individuals who put forth greater effort than the average performance, all workers should be paid, as far as is practical, for the hours they produce as measured by the work done rather than the time actually worked. However, even if conditions, such as provisions in labor contracts, do not permit the use of wage incentives, the budgeting of labor required in the performance of various tasks, and subsequent measurement with actual time taken still remains essential to the effective control of labor costs.

The establishment of the standard time for an operation on an item in production calls for the consideration of many factors. In general, if proper time

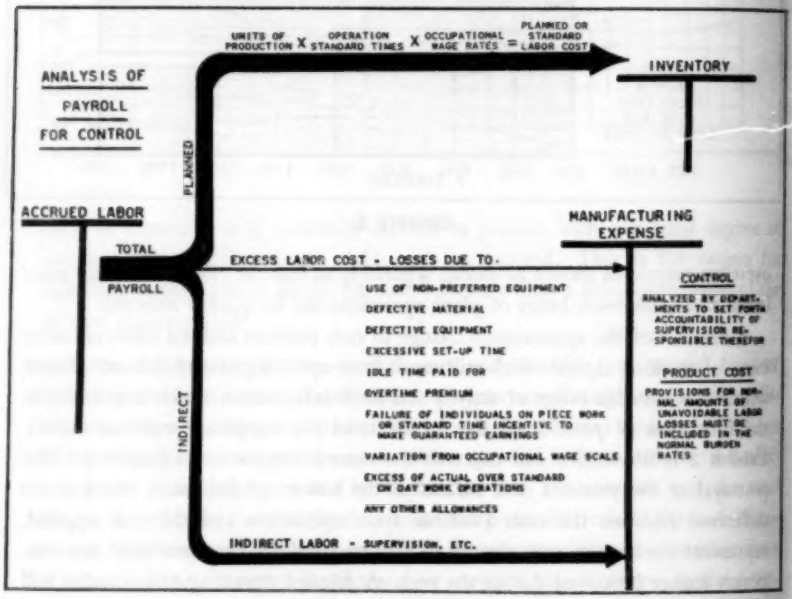

UNITS OF PRODUCTION X OPERATION STANDARD TIMES X OCCUPATIONAL WAGE RATES = PLANNED OR STANDARD LABOR COST
INVENTORY
ANALYSIS OF PAYROLL FOR CONTROL
PLANNED
ACCRUED LABOR
TOTAL PAYROLL
MANUFACTURING EXPENSE
EXCESS LABOR COST - LOSSES DUE TO:
USE OF NON-PREFERRED EQUIPMENT
DEFECTIVE MATERIAL
DEFECTIVE EQUIPMENT
EXCESSIVE SET-UP TIME
IDLE TIME PAID FOR
OVERTIME PREMIUM
FAILURE OF INDIVIDUALS ON PIECE WORK OR STANDARD TIME INCENTIVE TO MAKE GUARANTEED EARNINGS
VARIATION FROM OCCUPATIONAL WAGE SCALE
EXCESS OF ACTUAL OVER STANDARD ON DAY WORK OPERATIONS
ANY OTHER ALLOWANCES
INDIRECT
INDIRECT LABOR - SUPERVISION, ETC.
CONTROL
ANALYZED BY DEPARTMENTS TO SET FORTH ACCOUNTABILITY OF SUPERVISION RESPONSIBLE THEREFOR
PRODUCT COST
PROVISIONS FOR NORMAL AMOUNTS OF UNAVOIDABLE LABOR LOSSES MUST BE INCLUDED IN THE NORMAL BURDEN RATES

EXHIBIT 3

studies are made of the various elements of operations or processes, such as handling time, setup, running time based upon machine speeds and feeds, type of cutting tool, jig or fixture, etc., the standard operation time applicable to an individual piece can be predetermined from its size, weight, working surface dimensions, etc. Results of time studies should be so compiled that reference to the tabulations makes possible the predetermination of over-all operation time from product specifications before the items are placed in production. The establishing of equitable standard time allowances covering direct labor has been emphasized for many years. It needs also to be emphasized that the planning and controlling of all types of indirect labor is just as practicable and offers broad opportunities for improvement in operating results. All excess labor cost over the standard should be properly analyzed so as to set forth the reasons. Exhibit 3 clearly displays an analysis of labor cost reflecting the excess cost over the standard or planned cost by reasons for its occurrence.

Budgeting of the quantity of work to be performed per hour establishes not only a method of controlling labor cost and of determining product labor cost but it also establishes the basis for absorption of burden in product cost. The amount of manufacturing burden which is applicable to product cost is generally in direct relation to the time consumed in manufacture. Thus, to correctly apply burden, knowledge of the time required to manufacture the product is an essen-

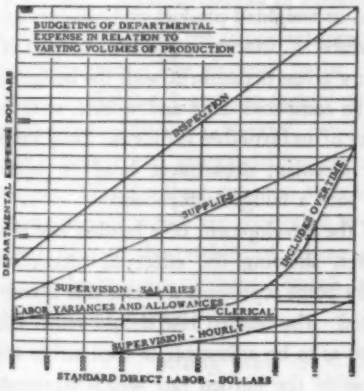


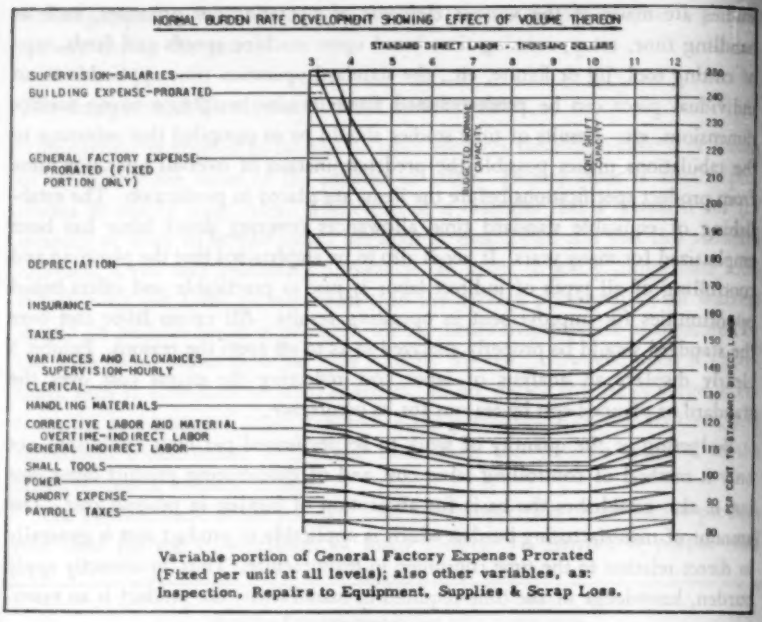
EXHIBIT 4

MANUFACTURING BURDEN ANALYSIS

DEPARTMENT _____ PERIOD _____

	ACTUAL	BUDGET	GAIN LOSS
DIRECT LABOR			
01 PIECE			
02 DAY WORK			
04 EXPERIMENTAL			
06 REPLACEMENT			
08 SERVICE			
TOTAL (DIRECT LABOR WEIGHT)			
DIRECT LABOR VARIANCES AND ALLOWANCES			
10 OCCUPATIONAL WAGE RATE			
11 SET UP			
12 DAY WORK			
13 WAGE GUARANTEES			
14 DEFECTIVE MATERIAL			
15 NON-PREFERRED EQUIPMENT			
16 IDLE TIME			
17 OVERTIME PREMIUMS			
18-29- · · · · ETC. ETC.			
INDIRECT EXPENSE			
30 SUPERVISION - SALARIES			
31 SUPERVISION - HOURLY			
32 CLERICAL			
33 HANDLING MATERIAL			
34 CORRECTIVE LABOR AND MATERIAL			
35 INSPECTION			
36 OVERTIME PREMIUMS - INDIRECT LABOR			
37 GENERAL INDIRECT LABOR			
38 REPAIRS TO EQUIPMENT			
39 SUPPLIES			
40 SMALL TOOLS			
41 POWER			
42 SCRAP LOSS			
43 SUNDRY EXPENSE			
44 PAYROLL TAXES			
45 WORKMEN'S COMPENSATION AND LIABILITIES			
46-59- · · · · ETC. ETC.			
TOTAL			

EXHIBIT 5



Variable portion of General Factory Expense Prorated (Fixed per unit at all levels); also other variables, as: Inspection, Repairs to Equipment, Supplies & Scrap Loss.

EXHIBIT 6

tial factor. Exhibit 4 illustrates a practical method of indicating budgeted or planned expense in relation to production within a given department of a manufacturing business. The same procedure is applicable to administrative or marketing functions, using dollar volume, actual or weighted product unit volume, etc. as units of measurement of activity. Exhibit 5 presents a practical method of comparing the actual operating results in a given department with the budgeted cost. Some of the items are suitable to be compared daily and weekly, so as to give opportunity for immediate correction of unfavorable variances. Only items of expense over which the individual foreman, department head or superintendent, has control are considered in such a budget comparison.

Exhibit 6 sets forth an illustration of the development of a burden rate in a specific department or production center, showing the effect of production volume on this rate. The normal capacity point represents a reasonable average operating condition which is contemplated. The burden rate should reflect this normal operation. It should be set up so as to be adjustable to conform to any set of operating conditions. The portion of the burden rate which represents variable cash expense and the portion representing fixed (cash and non-cash)

expense should be indicated separately. This information may be used for estimating the cost of marginal business.

Although it is essential that controllable expenses be classified according to the various functions, the extent to which burden rates should be developed by operations is influenced by the diversity of operations involved in the manufacture of the various products. In theory, each machine tool should have a burden rate. In practical application, small variations in the cost of operations and the relative time of each required in the manufacture of the products, may preclude the necessity of developing a large number of burden rates for product cost calculation.

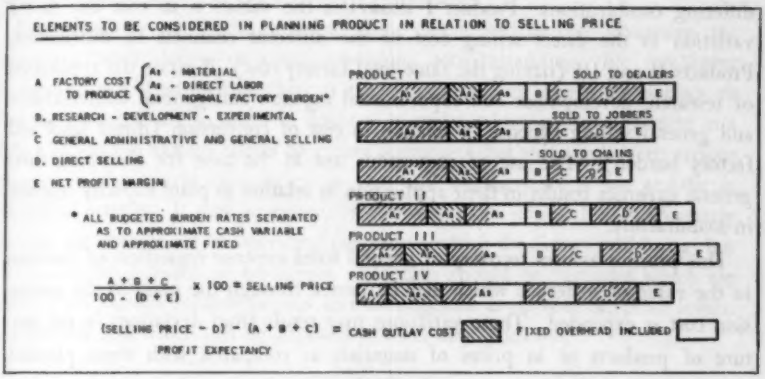

ELEMENTS TO BE CONSIDERED IN PLANNING PRODUCT IN RELATION TO SELLING PRICE
A FACTORY COST TO PRODUCE
A1 - MATERIAL
A2 - DIRECT LABOR
A3 - NORMAL FACTORY BURDEN*
B. RESEARCH - DEVELOPMENT - EXPERIMENTAL
C GENERAL ADMINISTRATIVE AND GENERAL SELLING
D. DIRECT SELLING
E NET PROFIT MARGIN
* ALL BUDGETED BURDEN RATES SEPARATED AS TO APPROXIMATE CASH VARIABLE AND APPROXIMATE FIXED
A + B + C / 100 - (D + E) X 100 = SELLING PRICE
(SELLING PRICE - D) - (A + B + C) = PROFIT EXPECTANCY
PRODUCT I
SOLD TO DEALERS
SOLD TO JOBBERS
SOLD TO CHAINS
PRODUCT II
PRODUCT III
PRODUCT IV
CASH OUTLAY COST
FIXED OVERHEAD INCLUDED

EXHIBIT 7

Principal Considerations in Planning Product Costs

We come now to the important topic of planning product cost for pricing and other purposes. The elements to be considered in planning product costs are shown in Exhibit 7 and are factory cost to product (material, direct labor and normal factory burden), research, development and experimental expense, general administrative and general selling expense, direct selling expense and net profit margin. Direct selling expense, such as cash discount, commission, advertising appropriations which are controlled by dollar volume, etc. and net profit are in direct ratio to the established selling price. To determine a price which will permit the recovery of these elements, the following formula, using the symbols on Exhibit 7, is helpful:

$$\text{Selling price} = \frac{A + B + C}{100 - (D + E)} \times 100$$

However, product selling prices are largely controlled by competition and

products must be designed in such a way that they can be produced and marketed at a profit when sold in a competitive market. The return to the company for comparison with other costs is represented by the selling price less the direct selling expense. If the estimated or planned cost of a product shows insufficient net profit when compared with the selling price at which it can be marketed, less direct selling expense, changes must be effected in the over-all operating planned expense appropriations or over-all planned activity so as to reduce burden cost applicable or else change must be made in product design so as to reduce material cost or time required in manufacture (which controls the labor and burden costs applicable).

In Exhibit 7, the application of cost elements to products is displayed in four differing combinations. Product I illustrates the variation in cost due to the variation in the direct selling cost of the different channels of distribution. Products II and III (having the same total factory cost) illustrate the application of research, development and experimental expense and general administrative and general selling expense in relation to cost of conversion (direct labor and factory burden). The use of conversion cost as the base for absorbing these general expenses results in their application in relation to plant capacity required in manufacture.

This practice assures recovery of general fixed expense regardless of variation in the value of materials which may be passed through the plant as the conversion cost is expended. These variations may result from deviations in the mixture of products or in prices of materials as compared with those planned. However, these fixed expenses should be spread to products on a properly weighted unit basis. Thus, the choice of either total cost, total conversion cost, conversion cost of primary operations only, or any other basis of weighting, should be governed by this objective—a properly weighted product unit. In this connection, in determining the gross margin sufficient to absorb general fixed administrative and selling expense and provide a reasonable profit, consideration should be given to the turnover of working capital in relation to cost of sales, and to the turnover of the investment in physical properties in relation to the value of the conversion cost produced.

Exhibit 7 also illustrates the determination of the direct cash outlay cost of various products, from which all fixed expense is eliminated. A competitive price condition may not permit the recovery of full normal cost and a knowledge of the cash outlay incidental to production and marketing, discloses the lowest selling price at which a product can be marketed with a cash margin return in excess of this outlay.

Budgeting Is Effective Use of the Information Available

The operating results of a business are in direct proportion to the care exercised in planning and controlling operations, and the major effort in modern cost procedure deals with the primary objectives of planning and control. The installation of effective means of controlling operating cost through the measurement of productive labor, the control of usage of materials, and the development of expense budgets for each volume of activity within each operating unit of the enterprise, serve to keep actual operating cost in line with planned cost. Daily, weekly, and monthly comparisons of the actual operating cost under the control of each department head with the amounts accepted as standard performance, identifies accountability of the executives responsible.

Every business can be budgeted to some extent and to real advantage, the seasons, weather, crops, or other conditions notwithstanding. No intelligent business man will admit that there is a basis wanting, or experience lacking, or that the prospects are so much in doubt as to make it impossible to estimate in a future period the various effects on future operations that will result from various changes in the operating policies, in cost and selling price levels and/or in volume of activity. It may be extremely difficult, if not impossible, to accurately forecast the specific set of operating conditions which the future will bring, but this is not the purpose of budgeting. Forecasts should be prepared which are based upon various contemplations and assumptions as to volume, price levels, and policies and which can be adjusted to meet any condition.

Pride in Performance – Not Position

by W. C. HURT, Jr.*

I READ WITH GENERAL AGREEMENT the very fine letter written by A. J. Horton in the August issue of the *Bulletin* entitled "The Cost Accountant and His Future." The one vital question, admittedly unanswered, is what sort of an administrator the cost accountant may become. Mr. Horton states that the cost accountant "lives and moves and breathes in an atmosphere which cannot help but provide opportunity for him to develop his administrative talents." True enough, the opportunity is there for the cost accountant, but it is there for everyone else as well. The development of administrative talent stems from study and a keen desire to become a successful

* Manufacturing Analyst and Buyer of Manufacturing Departments, Colonial Stores, Inc., Atlanta, Ga.

administrator. It does not happen because of exposure or opportunity. It happens because a man puts together a number of qualities aimed at controllership, technical know-how being but one factor among many others. Cost accountants will continue to be promoted to controllers or by-passed in favor of others, depending upon the recognition of factors inherent in all promotions of this kind.

The paramount factor in going into a line position in executive accounting, whether titled controller or something else, is to realize that the primary concern has shifted from figures and schedules to the effective utilization of people. Other factors are appearance, personality, technical knowledge, morals, or being less meritoriously favored etc., which are pretty well recognized by everyone and need no elaboration here. Following out this line of thought and realizing that some of us "beaten old accountants" cannot put together the qualities necessary for promotion to senior executive positions, I will, at the risk of being slightly traitorous to a great American tradition, offer a little homemade philosophy that may be small comfort to some but more than a little to others. I think there is something (not everything) to be said for the so-called "class" institution in England, and on the continent as well, where honor and pride are tradition by the passing of crafts and other specialities from father to son. Under those conditions, the son of a bank clerk may be a happy clerk rather than a neurotic bank manager and the son of a butcher may be a superlative butcher rather than a mediocre surgeon.

It is dangerous and misleading to believe too much in this, I realize, for many excellent performances have come from lowly backgrounds, but there is a point in this. Here is what I think it is. People should level to positions they can handle without undermining their health and happiness. Unfortunately, most people in this country are so imbued with the proposition that everyone can be president, that they are afraid of the ridicule that might accompany a more comfortable view of their potential.

Procedure Manuals Program the Work

by EDWARD MEZNER

GIANT ELECTRONIC COMPUTERS are revealing some surprises which small companies should note. One of the most significant of these emerges from the recognition that the electronic super-clerk can accomplish nothing unless it receives step-by-step instructions for every job. Study the job thoroughly so that you can write the instructions and you save money with or without the computer. Organize the work for the human clerk and he can expose the electronic clerk as the brainless (though extremely helpful) monster it really is.

It should be realized that every office procedure, manual or mechanized, properly has a three-or-four-phase cycle, illustrated in Exhibit 1, although the "revise" phase can often be by-passed. The electronic computer cannot actually remember, because it cannot think. It can select or write or add or multiply or "do" other work much faster and more accurately than a human being, but it does not have to think to do. It is dependent on human beings to review, revise, and understand what is to be done—in short, to think for the machines. In fact one big advantage of using an electronic computer is that we are forced to think to use it. Otherwise, the metal-skinned giant with the twinkling lights will just make errors faster than they have ever been made before!

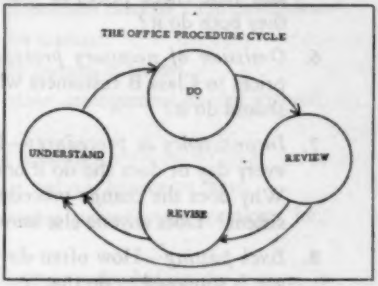


EXHIBIT 1

The Costs of Trying to Remember

We can find time to think constructively by saving time we now require to remember. We should review, revise, and understand procedures, and then express our findings in the written pages of a procedure manual. The time and cost of establishing and maintaining manuals have deterred many small offices from using them, but less obvious, yet no less significant, are the alternative costs of trying to remember the procedures or, more specifically, the costs of not being able to remember them accurately. The following are the costs of not having procedure manuals:

EDWARD MEZNER *(ROCKFORD CHAPTER 1946)*, has had his own practice as a Business Consultant in Rockford, Illinois, since 1956. Before that, he was with Lybrand, Ross Bros. & Montgomery for over thirteen years, the last five as Manager of the Management Accounting Department of the Rockford Office.

1. *High-priced personnel to do low-cost work*—Do you do some work that a $60-a-week girl could do? Why? Because "there are so many things to remember"? Do you excuse yourself because "by the time it takes me to show her how to do it, I could have completed it myself"?
2. *High training costs for new employees*—How much time do you spend showing a new employee how to do a job? Do you, yourself, know how the job should be done? Are new employees' errors showing up later?
3. *High employee turnover or absenteeism*—How much employee turnover or absenteeism is caused because employees are frustrated from not being able to do a good job? (If you answer "None," take another look.)
4. *Difficulty in alternating employees*—Do vacations, absences due to illness, or promotions put the office in a temporary upheaval?
5. *Duplication of work*—How much is it costing to have both Mary and Jane check prices to Class A customers? Does anyone know they both do it?
6. *Omission of necessary procedures*—Does Jean think Betty checks prices to Class B customers while Betty thinks Jean does it? Who should do it?
7. *Inconsistency in procedures*—Does Sue do her work the same way every day or does she do it one way one day and another the next? Why does she change procedures? Does she know she is not consistent? Does anyone else know?
8. *Buck-passing*—How often do you hear, "That's not my job. Johnson is supposed to do that"?

Unfortunately, offices which have the most serious difficulties are often the least aware of their problems. When disorder prevails for any length of time, office workers tend either to find new jobs or to adjust themselves to the situation, rather than complain to deaf ears. Meanwhile, the company continues to pay for the inefficiencies. However, these could be corrected if more time were spent—as we keep saying here—to review, revise, and especially to understand procedures, that is, to think rather than just to rely on memory to do the job right.

How Manuals Help the Office Procedure Cycle

The procedure manual is a partial substitute for memory. Its pages remind employees what to do, who does it, how to do it and, sometimes, when, where, and why. The manual helps the employees understand the procedures before

they do them. It eliminates guesswork which disrupts the orderly flow of work. At the same time, written procedures can be reviewed more easily and revised more quickly. Without procedure manuals, employees are more likely to revise a procedure without first understanding or reviewing it carefully. It is said that written, standardized procedures restrict individual initiative and discourage revision. The fault here is not in the written procedures but in the failure to use them fully.

If we suppose, on the basis of all we have said so far, that our small company is convinced that the costs of having an office procedure manual are less than the costs of not having one, how does it go about getting it? In much the same way as a large company, except that fewer people and less red tape are involved. The first step is to select an employee to take complete charge of the project, subject to supervision or review. The person selected should:

1. Read published material on the subject of office procedure manuals, and study how this material applies to his company.
2. Outline the general plan of the procedure manual. This includes:
   a. Procedures to be included in the manual.
   b. Procedures to review before the manual is issued.
   c. Classification of procedures, their arrangement in the manual, coding, and indexing.
   d. Type of manual, paper, page headings, style of writing.
   e. Distribution of the manuals, i.e., who is to receive them
   f. Method of reviewing and revising procedure instructions, i.e., keeping manuals up-to-date.
3. Decide which procedure instructions to write before the manual is issued. Here it must be determined whether all, or nearly all, of the procedures are to be written before the manual is issued. Or should the more important procedures be written and issued first? (The latter is probably best.)
4. Review the procedures to be written before the manual is issued. Talk to supervisors to learn how they think the work is done. Ask employees to write step-by-step descriptions of their work, or question them orally to learn how the work is actually done. Compare notes of different interviews for contradictions. (Bales says he gives Form 13 to Brown, while Brown says he receives Form 13 from Black.) Use flow charts to coordinate information. (This step in the procedure manual program could involve the entire broad subject of systems and procedures.)
5. Write procedures in rough draft form.
6. Review the rough drafts. Ask supervisors and employees who do the work to read and criticize the rough drafts. Does the writ-

ing interpret the procedures accurately? Are the procedure instructions clear to the people who are expected to use them?

7. Prepare the manuals in form ready for issuance. Procedures which will soon be revised substantially may be omitted from the original manuals. Do not hold up procedure instructions for minor revisions. Revisions may be made constantly. If you wait for them, the manual will never pass the rough draft stage.

8. Distribute the manuals. Some manuals should contain all procedure instructions; others may contain only sections applicable to specific departments. All employees should have easy access to procedure instructions applying to their work. Keep a record of the location of all manuals.

9. Keep the manuals up-to-date.

Physical Features of the Procedure Manual

Procedure manuals should be loose-leaf, to encourage revisions. A standard 14-ring binder using 8½" by 11" sheets is ideal. In this type of binder, new sheets may be inserted easily, and the large number of holes keeps the paper from tearing. High quality paper, pre-punched to fit the binder, should be used. A printed heading on the sheet helps to make standard information uniform. The heading may include such information as:

Subject	Date approved	Distributed to
Procedure number	Date effective	Forms used
Page number	Approved by	

Procedure instructions should be typed without crowding so that they can be read easily. About two inches should be left at the bottom of each page to allow for minor revisions. Copies of the manual pages may be obtained by using carbon paper, if few are required, or by whatever reproducing equipment is available in the office. High quality copies are desirable. When a procedure is revised, a new sheet is typed, the superseded sheet is removed from the binder and the revised sheet inserted in its place. The revised portion of the sheet may be emphasized by typing the word "Revised" in the margin. The superseded sheet should preferably be destroyed (or at least clearly marked as superseded.)

An orderly arrangement of the material in the manual is important. Classify all procedures into major groups, such as order and billing, cash receipts and customer credits, purchasing and receiving, etc. Present the procedures in each major group in the sequence in which they are performed. Write a separate procedure instruction for each job routine performed by one person. Write

RECIPE FOR LACY VALENTINE FROSTING

As It Appears In Betty Crocker's Picture Cook Book

"Bake favorite white cake in layers. Cut each slightly to heart shape. Frost with a white icing. For pink trim, mix 1 cup moist shredded coconut with 8 minced red cherries. Sprinkle over top. Place red cinnamon hearts on sides. Serve on a dainty lace doily".

As An Accountant Would Write It

Lacy valentine frosting should be made by carefully observing the following procedures: First, a white cake should be baked in layers. (Note: Any type of cake which falls into this category is satisfactory for this purpose.) Each of these portions should then be cut, in such a manner that the portions resulting therefrom appear to be shaped similar to a heart. Upon the successful completion of this operation, a white icing should be made. Add the pink trim by taking a cup of moist shredded coconut, mincing eight red cherries, and combining these two items into a mixture, which should then be applied evenly over the top of the cake which has been prepared according to the instructions previously given. The cake is now ready for the application of red cinnamon hearts on the side. Thus completed, the cake is ready for consumption. The serving may be accomplished most satisfactorily by application of a lace doily on the cake plate.

EXHIBIT 2

instructions for large volume jobs in greater detail than for small volume jobs. Code each procedure. The code should indicate the major group, the procedure number within a group, and any intermediate or sub-classification. Each manual should contain an index of procedures. A sub-index may be used in each major section. A summary flow chart may be included with the index to clarify the relationship between the procedures within a major group. Flow charts should show references to the corresponding procedure instructions.

Writing style is important. The main purpose of a procedure manual is to make procedures understood. It is a book of instructions. It tells what to do and how to do it—like a cook book. Leaf through the pages of one of your wife's cook books for some outstanding "how to do it" writing. Exhibit 2, (top) is a recipe for lacy Valentine frosting from Betty Crocker's Picture Cook Book. At bottom is the same recipe written in the usual accountant's style. Could your wife make lacy Valentine frosting from the lower recipe? Could you expect your employees to understand procedures for doing office work when they are written in the same style? Exhibit 3 is illustrative of satisfactory style.

Maintenance of a procedure manual is also an essential function. The manual is of little value unless it is kept up-to-date. In a small office, one person should be responsible for distributing revised sheets and collecting superseded sheets. The same person should preferably write all instructions or, at least, review them

THE N. A. A. COMPANY

STANDARD PROCEDURE

Subject		S. P. No. A. 1. 1.
STANDARD PROCEDURE MANUAL: WRITING PROCEDURES		Page No. 1
Issued to	Applies To	Effective Date
JKL, SOO, PJ, STD, BTC, EM	All supervisors	10-28-57

Standard procedures should be written in the same general style by all persons who write procedures.

PROCEDURES:

1. Indicate all information in the standard procedure page heading (for the typists use).
2. Write the procedures in the form in which they will be typed. (See the procedure on "Typing standard procedures".)
3. Limit a procedure to one basic routine performed by one person (unless two or more employees do the same job, or work together on a job). Break down a job into more than one standard procedure, if this will make the instructions easier to understand.
4. Write the standard procedure in two parts:
   a. A summary of the work, or a brief explanation of what the job is and how it is related to other people's work.
   b. Procedures, or fairly detailed step-by-step instructions explaining how to do the job. Reasons for doing the job may also be included.
5. Write the procedure section as a set of instructions.
   a. Use the "cook book" style of writing. Begin each instruction with a verb. Use short sentences. Take operations in order. Be thorough in the instruction, so that a new or substitute employee can do the job with a minimum of help from others.
   b. Number each major step in the procedure.
   c. Letter sub-steps, if this will make them easier to follow.
   d. Give reasons for the procedure, if the employee may not be aware of why he does it. Employees do better work if they feel they are doing something useful.
   e. Use the positive approach. Tell the employee what he should do, rather than stressing what he should not do.
   f. Ask the employee to whom the procedure applies for his comments on the written instruction. The employee may point out inaccuracies in the instructions. He may also suggest a simpler method of doing the work.
6. Give written procedures to the office manager for approval before typing.

EXHIBIT 3

and coordinate them with the basic plan. He should make a periodic review of the procedure instructions to make sure they are current, complete, accurate, understandable and easily located.

Less Need to Remember — More Time to Think

Step-by-step instructions for employees offer the same advantages to a company as detailed programming for giant electronic computers. Computers can operate only when they receive accurate instructions. Employees work more effectively when procedures follow an organized plan. Procedure manuals lay out that plan. When procedure manuals are used, less time is required to remember, or to try to remember. More time is available to think—to decide which procedures need review and how they can be revised, making them easier to understand and to do. The thorough review required to establish the first procedure manual offers a small company a substantial share of the benefits that large companies receive when they install giant electronic computers.

JOINING FORCES IN EDUCATING THE ACCOUNTANT

by M. B. GREULACH and L. RIGNANESE*

THE MYRIAD OF CHANGES that have taken place in our economy in the last decade has placed a strain on our educational system in their attempt to keep pace. In addition to providing the potential accountant with basic accounting fundamentals and principles, he has to be kept abreast of the most modern professional techniques, equipment available, and management practices, as well as impact of taxes on the economy and business methods. However, basic accounting principles have not changed over the years and will not, regardless of economic changes, despite the fact that their application to automation, new equipment, management techniques and tax requirements will change. Can accounting instructors, then, be expected to cease teaching principles, "pure and solid," and attempt to train accountants for business and industry based on individual types of activity? We think not.

The school recognizes the need and necessity of its educational processes to keep pace with industrial progress. The teaching of accounting must, in spite of many criticisms, originate with theory; practical situations cannot possibly be fathomed by the student unless he is aware and has an understanding of the most widely-used accounting principles and practices. To add to this, if the accounting school attempted to teach all the accounting modifications found today, even if known, no one studying accounting on a full-time basis would ever leave the classroom. Some practical balance is needed. The one popular and also practical approach is the problem method of teaching. The student, rather than being subjected to a series of lectures, is exposed to accounting problems which are categorized under the various topics to be examined in the classroom within a given period of time. In arriving at the

* Cost and Advanced Accounting instructors at International Business College, Ft. Wayne, Indiana.

solution to the problems, the instructor discusses the principles of accounting that are involved. This method provides the student with principles as background to situations. It is true that the value of the accountant's services to his employer can be greatly enhanced if he is aware of the many problems faced by his business organization and if, in light of these problems, he is able to make recommendations. This additional opportunity requires that the accountant be able to express himself clearly and concisely in writing. Here is another area in which the school can and does assist the basic accounting training from a broad viewpoint.

The problems mentioned above are not idle ones. Something must be done to solve each and every one of them, and this requires understanding on the part of business, teacher and student. The relationship between businessmen and instructors must be fully understood by each in order to analyze mutual problems for their eventual solution. Steps in this direction can be initiated by either party. Let the school know what business and industry needs in accountants and where the educational process needs to be strengthened. The prospective employer of an accounting graduate can start by:

1. Taking more interest in the schools and colleges from which he gets his accountants.
2. Visiting the classrooms, talking with the instructors, and examining the textbooks used.
3. Encouraging plant visitations where the students are given the opportunity to take notice of the techniques used in business.

The instructor of accounting can develop greater understanding by:

1. Being an active member in accountants' professional and educational organizations.
2. Continually seeking guest instructors or speakers from the business world to assist in the orientation of his class in the day-to-day accounting problems.
3. Accepting summer jobs in which theory taught in the educational institutions can be put to practice.

Education is perhaps the most productive activity going on within a democracy. With the close cooperation of business and school, education for accountants can be greatly broadened and enhanced, bringing about a much fuller measure of success for all those concerned.

Application of Cost Accounting In a Government Department

by DELORIAN J. LUCAS

IT WAS NOT UNTIL 1953 THAT THE POST OFFICE DEPARTMENT embarked upon a program to take full advantage of management tools which have been used in industry for a long time. Prior to 1950, the general accounting for the Post Office Department was performed by the General Accounting Office in a separate unit located in Asheville, North Carolina, to which all vouchers and records of the Department were sent for continuous audit. The principal purpose of the audit was to verify the legality of the department's expenditures. The first Hoover Commission recognized the wholly unsatisfactory character of this arrangement. It recommended a reorganization including accounting, budgeting, and auditing procedures designed to improve management's control of the operations and extending to a comprehensive cost control system. Largely as a result of this latter recommendation, the Congress enacted the Post Office Financial Control Act (P. L. 712—81st Congress, approved August 17, 1950), which was the basis for the sweeping changes now fulfilled.

Preparatory Actions

In preparing for more direct management action, Postmaster Summerfield's first step was to concentrate accounting, budget, cost analysis, statistical and internal audit functions in a bureau of controller. This was completed on November 1, 1954. On November 24, 1953 he inaugurated the first postal region in Cincinnati which delegated authority over postmasters to the regional field managers. This has subsequently been extended to include all of the United States and its possessions so that now all of the 38,000 postmasters report to fifteen regional operations managers. Previously, all post offices reported directly to Washington. This change was accompanied by decentralization. Controllership has likewise been decentralized to the fifteen regions in order to provide locally to the director, his staff and to the individual postmasters valid, timely accounting data with which the various managers can take immediate and positive corrective action.

The Post Office Department put into effect for fiscal 1957 the 13-period accounting year. It is the only Federal agency using this procedure. The periods

DELORIAN J. LUCAS *(DENVER CHAPTER 1951)*, is Regional Budget Examiner, U. S. Post Office Department, Denver, Colorado Region. Mr. Lucas has been associated with the Post Office Department since 1937, where he served in accounting and administrative positions, progressively advancing to his present position.

synchronize with two-week pay periods. With payroll such a large portion of total expenses, inaccuracies in accruals have been reduced to a bare minimum.

After taking these actions to assure necessary organizational climate, emphasis was placed upon the development of sharp "working tools," as follows:

1. Budget—A Business type budget was introduced and improved methods adopted for budget estimation and presentation.
2. Accounts—A classification of cost accounts was developed to furnish management with cost data required for effective operational control. These accounts have recently been completely integrated with general ledger and budget accounts, so that a complete and universal system of accounts is in use.
3. Accounting—Decentralization of accounting to the regional level has been accomplished and each regional office now has its own complete finance and accounting entity.
4. Additional accounts—Accounts were added to include equipment shops, supply centers and other similar service activities on a basis which result in meaningful determination and distribution of costs.
5. Business principles—Emphasis has been placed on income and expenses and upon financial condition.

Current Applications of Cost Accounting

One of the major facets of the financial improvement program of the Post Office Department has been the development of cost accounting data which will provide management with effective tools for control, planning and obtaining optimum operating efficiency. In a business-type operation of this magnitude, the potential value of accurate and adequate cost data can hardly be overestimated. Previously, there existed a serious lack of cost information upon which management could make decisions and direct attention immediately to conditions requiring corrective action. Within a period of three years, substantial progress has been made in the cost accounting area. Many specific examples of what has been accomplished are outlined in these paragraphs.

For example, weighting factors have been developed to convert the volume data for different types of originating and incoming mail to uniform composite workload figures for comparison with total manhours used. A few of the important post office operations cost programs conducted during fiscal 1956 are outlined below:

1. Workload reporting methods have been analyzed and procedures installed leading to more accurate volume reporting.
2. Initial studies have been undertaken of the ratio of supervisors and clerks and mailhandlers related to production performance.

3. Studies have been made of manhour time reports and recording methods as the basis for developing better manpower control.
4. Analyses were prepared of trends of revenue, payroll and workload for major offices under the work performance standards systems.
5. Procedures have been drafted for measuring performance and costs of operation of regional controller offices.
6. Other cost studies in progress include analyses of post offices' color, light, and ventilation program; relationship of revenue to mail volume; and study of fixed and variable expenses in postal operations.

Areas of Outstanding Improvement

Important achievements have been made in the development of postal facilities costs, especially in the installation of cost accounting systems for motor vehicles, mail equipment shops, and the mail bag repair units.

The postal establishment operates a fleet of over 24,000 vehicles, one of the largest in the country. In order to provide management with operating cost data on which to base decisions, a new motor vehicle cost accounting system was developed and installed in collaboration with the division of vehicles, bureau of facilities, and the office of the chief industrial engineer. The new system is nationwide and extends to 169 vehicle personnel offices (garages) and 2,635 other post offices which use government-owned vehicles. Concurrent with the installation of the new system, a vehicle accounting manual was written and put in use. It is being revised to incorporate improvements and simplifications made during fiscal 1956. Management at all levels receives monthly reports showing vehicle operating costs in terms of consumption of gasoline and oil, repair parts and materials, repair and service labor, and supervision expenses.

All vehicles are grouped into 15 motor vehicle pools, one for each region. These pools include contract vehicles used by the post offices as well as government-owned vehicles. Although many of the vehicles are not physically located in central garages but are housed at the point of use, the regional vehicle manager has control of them. Complete costing is maintained on each vehicle and detailed data by vehicle is made available showing miles traveled, hours in use, cost of gasoline, oil, and repairs, and other significant data which permit the vehicle manager to measure performance, not only for his over-all operation but even for each specific vehicle. Thus, through evaluation, comparisons are made to determine whether or not it is more economical to use contract or government-owned vehicles and to identify vehicles with operating and repair costs above standard and which should be over-hauled or replaced, as well as vehicles which are not receiving sufficient use to justify their assignment to a post office.

A pool billing procedure has been installed to relate vehicle costs to the service rendered and to identify major segments of costs and demand for service. A procedure was developed for comparing vehicle costs with budget allotments to pin-point significant variances from budget estimates. In order to accelerate reporting, strip-board procedures were developed for the rapid assembly and reproduction of reports.

A standard cost accounting system was developed and installed at the mail equipment shop which manufactures and repairs mail bags and locks. Under this system, standard production rates are established for each direct labor operation on manufactured items. The actual production is compared with the standard rate and shop management is provided with timely reports which pin-point operations or units which are not operating efficiently or according to schedule. Introduction of modern management techniques, including the proper use of meaningful cost information, has already resulted in important manufacturing improvements. The standard cost system developed at the mail equipment shop is being integrated with the departmental uniform classification of accounts. On July 1, 1955, physical inventory of equipment and fixtures was taken, which resulted in a redetermination of estimated service lives and revision of allowances for depreciation. Overhead expenses were classified by producing and service departments.

A cost accounting and production system was designed and installed at the newly-established mail bag repair units located at New York, Chicago, Philadelphia, St. Louis, Cincinnati and Atlanta. A perpetual inventory system for materials and supplies was also developed and installed at these six units. The following data is furnished under the new system:

1. Quantity of units produced.
2. Total costs and unit costs of material, labor, and overhead expenses.
3. Comparison of actual with standard production rates by the various operations performed on each type of sack or pouch.

During fiscal 1956, the major cost projects conducted in the area of transportation were the following:

1. In collaboration with the office of chief industrial engineer, estimated costs of operation of newly-designed equipment and facilities, in comparison with current operations with existing plants and equipment, were reviewed and analyzed.
2. In cooperation with the Bureau of Transportation, the following projects were conducted:
   a. A review is in progress of a sample selection of airmail dispatch bills to determine the effectiveness of the application of short-

line distance payment concept in air transportation to assure minimum air transportation expense.

b. Analysis of improved procedures at postal transportation service installations to determine cost differences resulting from improvements.

c. Establishment of revised methods for star route contractor payments and postal transportation mechanized payrolling to assure availability of identifiable cost and volume data for regional transportation cost analysis.

d. Analysis of manpower use, salary expense and work-load for all postal transportation service operating organizations.

The Work Performance System

The department's work performance system program was initiated at large post offices in June 1953 to fill a vital management need of measuring the efficiency of work units, particularly those engaged in processing and handling mail matter, comparing performances of post offices, evaluating budgets, controlling costs, or directing attention to profitable areas for training, methods improvement, equipment and plant development, or supervisory assistance. The program which has been developed is a system of basically simple records and reports which provide the department, as well as postmasters, transportation and other supervisors, the needed tools for:

1. Effectively controlling operations.
2. Locating outstanding as well as substandard performance areas.
3. Comparing performance of like operations.
4. Appraising the effect of changes in organization, methods and procedures, personnel recruitment policies, training, physical layout, equipment, etc.
5. Forecasting and justifying future personnel requirements in relation to projected volumes of work.
6. Balancing personnel and workload.
7. Eliminating present multiple reports of manpower, workloads, etc.
8. Securing accurate data indicating performance of each operation for a base period to be used to measure changes in efficiency in the conduct of the operation.
9. Determining the amount of work that should be expected of employees performing the various operations under normal working conditions.
10. Determining unit costs and production rates which can be readily translated into funds required.
11. Measuring and comparing the effectiveness of supervision.

Work performance standards are in effect at 43 large post offices and seven stationary postal transportation service units covering 60 mail handling installations. The post offices reporting under these procedures represent approximately one-half of all employment of supervisors, clerks, and mail handlers at first and second class offices. Under the system, the mail processing operations performed by supervisors, clerks, and mail handlers are grouped into three classifications:

1. Distribution operations (directly variable with volume).
2. Distribution service operations (indirectly variable with volume).
3. Distribution non-standard operations (non-variable).

The application of the work performance standards data and analysis of recurring reports submitted by participating offices has been intensified. Postmasters at offices operating under the system are being provided with successive four-week statements of progress, including evaluations of changes in efficiency. A comprehensive study of the work performance standards system at the Chicago post office was conducted and, in fiscal 1955, a report setting forth certain recommendations was prepared. Several pertinent conclusions were reached and recommendations made:

CONCLUSIONS

1. Some of the present standards appear to be unrealistic or unattainable.
2. Results in terms of improved efficiency and decreased work hours will come only through effective use of work performance standards data by management.

RECOMMENDATIONS

1. Review of standards to assure that they are realistic and attainable.
2. That the work performance standards program should no longer be considered an experiment or confidential.
3. Use of standards data to plan future operations as well as to measure performance against pre-determined plans.
4. Change of the name of the program to "operations planning program."
5. Coordination with other man-hour and labor reporting systems.

An important study of the work performance standards was made by a special committee appointed by the Deputy Postmaster General to appraise the system and make appropriate recommendations for the achievement of its objectives. In May 1956, an inter-bureau committee on work performance standards was established to assist the chief industrial engineer and to advise him on develop-

ing objectives and to achieve an improved work measuring system for the Post Office Department.

Mail Volume Measurement; Special Studies and Surveys

One significant factor which has not been available for measuring the efficiency of a post office is the actual workload involved. For example, the postmaster of a location where a large publisher is located receives full credit for the postage paid on the magazines, while his office does little of the total work involved. Therefore, it is clear that, for any particular office, revenue is not a reliable measure for workload. The only acceptable measurement for workload appears to be a count of the volume handled. Counting any product, including mail, is an expensive operation. To hold the costs to a minimum, it was decided that only offices with annual receipts in excess of $200,000 per year would conduct mail counts. These offices account for approximately 60 per cent of total post office expenses and 70 per cent of revenues.

Each first-class office having $200,000 receipts and above now reports originating and incoming mail volume to regional controllers at the end of each four-week accounting period. It is planned that regional controllers will calculate the equated pieces of mail for each of these offices which is not already under the work performance standard system. The total equated pieces of mail for each office will be compared with the total work-hours of supervisors, clerks, and mail handlers for each accounting period, and the average production cost in terms of equated pieces of mail per hour will be calculated. From these production records, offices which are outstandingly above average will be isolated for study on an exception basis and also those below average. This will disclose areas for the industrial engineers to recommend equipment needed to assist postmasters to maintain average or better production performance.

During the past three years, over 150 special cost studies have been conducted to provide management with data needed in formulating policies regarding postal rates, extension of certain types of delivery service, revenue and volume or other cost data. During the same period, over 150 major projects have been completed involving changes in practically all phases of the department's financial and accounting operations. Due to the speed with which certain improvements were instituted and to a general shortage in qualified staff, changes cannot always be fully followed-up to determine their over-all application in all of the field offices. Moreover, it is known that further refinements are needed in certain areas. Critical post-installation surveys are to be made of the operations of these newly installed procedures. Beyond these particular surveys, it will be necessary to periodically review and re-survey procedures throughout the department.

SUPERVISORY CANDIDATE EVALUATION

by Rayford W. Harwell*

THE ARTICLE, "Developing Supervision in the Accounting Department" by E. E. Roll in the June 1957 issue of the *Bulletin* is based upon the principle that every accountant who hopes to attain management status must be able to achieve results through people. Without the cooperation of other human beings, the modern office cannot function properly. To recognize that a supervisor possesses and exercises the ability to win cooperation is perhaps the highest tribute that can be paid him. In a sense, it is the culmination of the successful application of all the scientific principles of management.

I agree with Mr. Roll that the choosing of supervisors is the starting point in building an effective organization. The selection of the individual best fitted to perform as an accounting supervisor is essential in the practice of the science of management. This can be accomplished only through the installation of a well-organized supervisory candidate selection program. The controller should be very much interested in the conduct of such a program. In a smaller company, each department head should be responsible to foresee the need for supervisory personnel and to plan ahead for this need by establishing within his department a pool of employees qualified to become supervisors. The following paragraphs outline a procedure recommended for the larger organization in the selection of supervisory candidates and the appointment of supervisors.

Candidates may be nominated by a department on a supervisory candidate evaluation form such as is shown in Exhibit 1. Copies of this form, signed by the candidate's department head and immediate supervisor, should be sent with the department employee record to the personnel department. This department conducts a thorough investigation of the nominee, including education, previous work experience, company experience, performance review sheets, his standing in the community and any other factors that might have an influence upon his personal conduct. The personnel department then notifies the department head of the investigation. If its results are satisfactory, the department notifies the employee that the company is interested in his possibilities as a supervisor and asks if he is interested in being considered further.

If so, an interview is arranged with the department head or designated interviewer. Only supervisory personnel reporting directly to the department head, who are trained in the techniques of interviewing, should be

* Accounting Supervisor for Convair, division of General Dynamics Corp., (Fort Worth).

SUPERVISORY CANDIDATE EVALUATION

Name _____ Dept. and Employee No. _____
Last First Middle

Position being considered for _____ in Dept. _____ Present Shift _____

Present Job Title _____ Date of Birth _____ Education _____

I recommend subject employee be considered as a supervisory candidate based on my observations of him as indicated: (State facts upon which rating is based)

1. His leadership traits
2. Proof of his dependability
3. Proof of his cooperation
4. Evidence of his sound initiative
5. Evidence of his sound judgment
6. Indication of his energy
7. How long have you known this employee?
8. Other comments

(In actual use, adequate space is allowed for replies)

Date _____ _____
Signature of Recommending Supervisor

Date _____ _____
Signature of Dept. Head - Requesting Dept.

Date _____ _____
Signature of Employee's Dept. Head

EVALUATION RESULTS:
Cleared _____ Rejected _____ Date _____

Signed _____
For Supervisory Selection Board

EXHIBIT 1

designated. The interviewer must be a qualified person other than the one submitting the candidate. At the interview, the program is explained to the candidate. After recording his appraisal of the candidate's personality, attitudes and capabilities on the Supervisory Candidate Selection Interview Form (Exhibit 2), the interviewer signs and forwards the form to the training section which schedules the candidate for testing in the fields of mental ability, human relations and supervisory responsibility. The following examinations for the candidate are recommended:

1. General ability—The Scovill Classification Test was designed specifically for measuring the general ability of applicants and has been found by many large organizations to be particularly well suited for evaluation programs in manufacturing plants.
2. S. R. A. reading record—This is specifically designed to measure a person's reading ability.
3. Company work knowledge—Examination on this subject should be prepared by the department from which the candidate is submitted. It should relate directly to the work performed in that department and any other information which the department head feels the candidate should know about the job.
4. Supervisory attitude—A very important factor in the program should be the prospective supervisor's attitude regarding the handling of situations which arise from day to day in his association with people.

The examination should be composed of more than fifty statements to be indicated as being true or false.

5. Company policy—This could be a multiple-choice type of test based on management principles and information contained in the company management manual.

SUPERVISORY CANDIDATE INTERVIEW FORM

Name_____ Dept. and Employee No. _____

Position being considered for_____ In Dept. _____

His present length of employment (in months)_____

I have interviewed subject employee for the purpose of evaluating him as a supervisory candidate. This interview took_____ Minutes.

My opinion of his ability to supervise workers is based upon my observations of the following traits and attitudes:

(Grade each factor on an ascending scale from 1% to 10%. A desirable Minimum total score is 60%)	In my opinion he needs training in the following areas:
1. His physical appearance	1. Company organization
2. His ability to express himself	2. Company policy
3. His composure	3. Job operation
4. His ability to command respect	4. Supervisory techniques
5. His liking for people	5. Speaking
6. Pride in his present job	6. Reading
7. His knowledge of the Company	7. Writing
8. His opinion of the Company	8. Attitude
9. His enthusiasm for promotion	9. Other
10. His knowledge of a supervisor's duties.	
11. My total estimation of his abilities	

(Form as used has spaces opposite each of the above items)

RECOMMEND

Based upon the above evaluation I DO NOT RECOMMEND further consideration of this employee as a supervisory candidate.

Date_____ _____ _____ _____

Interviewer Job Title Dept.

EXHIBIT 2

A supervisory selection board which makes the final decision under such a program should not approve candidates who have failed to meet the desirable test minimums, without overriding reasons. At its discretion, the board may interview the candidate or make recommendations to the department for his remedial training or further self-improvement. The training section notifies the department of the action of the supervisory selection board and places the names of approved candidates in a pool from which appointments can be made.

Without a proper management training and development program and a pool of qualified accounting supervisory candidates, a company cannot be prepared to accept the obligation of business and industrial leadership.

Cost Reports for Departmental Cost Control

by WILLIAM W. WRIGHT

IT IS THE PURPOSE OF THIS CASE STUDY to describe the various control techniques applied to production operations for TRANSITE® pipe. This is an asbestos-cement product line consisting of several product types, each of which is produced in numerous sizes. The term "standard" will be used frequently. It is considered to be the quantity of direct material, direct labor, or direct expense required to produce a unit of a product and is calculated by industrial engineering studies as being attainable under normal operating conditions with efficient performance. When a variation from standard is stated in dollars, this is the result of multiplying the difference between standard and actual quantities by current prices for materials or rates for labor.

As a result of working with our plant managers to determine their needs, it was decided that they should be provided with a brief monthly summary statement which would show, in comparison with accepted means of measurement and with data for prior periods, how effective a job had been done in each production department. Then they also would need detailed statements which would show their superintendents and themselves pertinent analysis of cost elements and/or operations to which it appears regular control attention would be desirable.

Summary Report of Department Operations

The top section of Exhibit 1 lists direct costs by major category. This data quickly tells the department superintendent and plant manager how well the production department met its engineering standards for the month. Management can compare the results for the month with those for the year-to-date. A plant manager knows that the standards were developed by an industrial engineering department under his supervision, and are the result of careful studies, so as to represent what can be termed standards of good performance. The division production manager who has responsibility for several plants can review comparable total plant production statements for each of his plants in much the same manner as the plant manager reviews the statement for each shop. The individual items of the top section of Exhibit 1 merit examination in detail.

Material direct cost is the dollar value of all raw materials used during the

WILLIAM W. WRIGHT, *RARITAN VALLEY CHAPTER (JACKSON 1948)*, is Corporate Budget Manager of Johns-Manville Corporation, and has been associated with this company for the past fifteen years where he held various accounting and administrative positions. Mr. Wright is past President of Raritan Valley Chapter.

PRODUCTION

DIVISION PIPE — NO. 220

PLANT HAUKEDAN — RESPONSIBILITY TRANSITE PIPE — MONTH FEBRUARY 1956

	CURRENT MONTH		% COST TO STD.	YEAR-TO-DATE		% COST TO STD.
	COST	VARIATION		COST	VARIATION	
Material - Direct	204,600	* 4,050	*102	440,000	* 1,250	*100
Usage Variation - Own Make	XXX			XXX		
Blends		* 6,370	*104		* 9,450	*102
Other		* 7,600	*100		*10,700	*100
Direct Labor (Less: Overtime & Shift Premium)	61,000	* 1,200	*102	128,400	* 2,600	*102
Direct Expense Steam	4,000	* 50	*101	8,100	* 140	*102
Fuels	16,000	800	95	33,500	1,200	97
Shop Expense (Actual)	70,000	XXX		150,500	XXX	
Scrap Credit						
Total	355,600	*18,470		760,500	*22,940	
Other Manufacturing Costs:						
Charge for Facilities (Abs.)	17,100			36,500		
Plant General Expense (Abs.)	44,500			91,500		
Overtime Premium - Direct Labor	2,600			5,600		
Shift Premium - " "	1,300			2,650		
Over-absorbed Shop Expense	5,500			9,800		
Total Cost of Production	426,600			906,550		
Cost of Shipments						
Net Shipments:						
Own Make Material	450,000			920,000		
Outside Make Material	20,000			46,000		
Shipping Cost (Absorbed)	22,000	250	99	45,000	490	99
Total Cost of Shipments	492,000			1,011,000		
Adjustments:						
Inventory Loss Due to Damage	* 200			* 450		
Inventory Quantity Differences	* 100			* 140		
Inventory Loss - Defective Goods	* 100			* 310		

Percentage of Production to Normal Volume: This Month 120% Year-To-Date 122%

* LOSS

DATE ISSUED 3/12/56

EXHIBIT 1

month which are directly assignable to products, including any packaging materials added before finished products are put into storage. In the next column

is shown the value, at current prices, of the difference in quantity between the standard and the actual amounts used. In our example, it is $4,050 (unfavorable). The following column shows the ratio of cost to standard, a figure higher than 100 per cent representing usage greater than standard. The efficiency of usage can be affected by various factors. For example, the yield from the raw materials may be different from standard, or rejects may be greater or less than allowed in the standard. The item "own-make," separated into two groups and representing usage of in-process material from one costing center of the department to another, shows variation (and percentage) computed in the same manner as for raw materials, but no figure is shown in the cost column since the original expenditures represented by this in-process material lost, have already been included as raw material, labor, and overhead cost elsewhere on the statement.

The entry in the cost column for direct labor represents the cost of direct labor man-hours worked excluding premiums for overtime and shift differential, because they are not always incurred. By treating these premiums separately, effectiveness of labor is not distorted in the comparison of varying time periods. The variation of direct labor from standard represents the value, at current straight-time labor rates, of the differences between actual hours and standard hours. The standards for labor include allowances for such factors as personal fatigue, machine setup, downtime, etc. Standards which are used for computation of incentive premiums are also used for measuring and reporting effectiveness except for special circumstances for which industrial engineers decide that they can provide an even more effective measurement.

Direct expense is a significant element of cost, normally classed as expense, but the use of which can be identified with a product or group of products. Standard usage per unit of product can be established by engineers and the quantity used can be determined for an accounting period. For example, in this exhibit, steam (unit is M lbs.) used for curing of TRANSITE pipe and felts (unit is lb.) used in forming pipe are such measurable items of direct expense. Shop expense represents the dollars of indirect expense incurred under the supervision of the pipe superintendent during the month. A scrap credit line appears on the form but, for pipe, no credit is currently allowed, since scrap is usually re-used in the same product group from which it was obtained and no significant inventory of used scrap tends to accumulate for future use.

Below the controllable costs are listed elements of cost not directly subject to the superintendent's control. Charges for facilities and plant general expense are amounts absorbed in cost of production on expense rates established for estimated expense at normal volume. Overtime and shift premium relative to

direct labor are considered in total with other direct labor in any computation of unit costs but, as these items are, in effect, types of price variation, they are excluded from the direct labor on which effectiveness of labor is measured. They are not entirely within the control of the department superintendent. Over-absorbed shop-expense is the difference between the amount of actual shop expense shown at the top of the statement and the amount absorbed in the volume of production for the month. Absorption of this expense is based on rates set for the estimated level of expense at normal volume. A total cost of production is then arrived at which represents the actual cost of the direct items and the absorbed portion of the indirect items for the current month.

The cost of shipments section lists data relative to shipments. Until costs used for costing quantities of shipments are based on the same policy (i. e. actual expenditures for direct cost elements and absorption of indirect expense) as those in the cost-of-production section. Below the section on shipping data is listed the value of the adjustments to inventory and cost of sales for the month. As adjustments can be due to several unrelated causes, each of which can be significant, we report amounts for each cause separately so that management is informed as to the origin of all such losses. There is one more item on the report, namely, the percentage of production to normal volume. As effectiveness may be, and expense absorption is, influenced by the degree of activity, there is shown the percentage of current level of production to the predetermined normal volume upon which absorption rates are based. This enables the reader of the report to consider the current variations and absorbed amounts in the light of current production level as compared to what is considered to be average volume for a business cycle in which, time-wise, the current year is at or near the mid-point.

Detail Report for Control of Shop Expense

The Shop Expense statement (Exhibit 2) is limited to expenses of production departments, and does not include costs incurred by service departments, such as purchasing, traffic, etc. Shop expense amounts to about 15 to 20 per cent of the total cost of producing the company's products and is, therefore, regarded as being of considerable importance in the over-all plan of cost control. The arrangement of the information in Exhibit 2 follows a conventional pattern. Budgetary control operates on group totals. A shop superintendent usually has to explain to the manager only when one of these control totals shows an unfavorable condition to the extent that actual exceeds the budget by a specified amount, such as $300 or 3 per cent, whichever is greater.

Each production superintendent is responsible for proposing expense budgets

SHOP EXPENSE

PLANT WAUKEGAN

RESP. TRANSITE PIPE

MONTH FEBRUARY 1956

Description	THIS MONTH			YEAR-TO-DATE		
	ACTUAL	BUDGET*	%	ACTUAL	BUDGET*	%
01 Salaries	7,000	7,060		13,880	14,100	
02 Overtime (Salaries)	1,100	1,650		2,190	3,300	
10 Supervision & Clerical	1,930	2,090		3,750	4,040	
12 Prod. & Inv. Checkg.	20	50		40	90	
ADMINISTRATION	10,050	10,850	93	19,860	21,530	92
18 New Work - Labor	880	560		1,280	1,160	
33 New Work - Material	650	360		1,380	720	
20 Moving Equipment	310	530		440	1,050	
IMPROVEMENTS	1,840	1,450	127	3,100	2,930	106
171 Rep. Labor - Mech. & Exp.	12,900	11,640		24,000	22,600	
- 43 Wearable Prod - Supplies	3,320	4,000		6,610	8,720	
46 Office Forms & Supplies	20	30		80	70	
48 Small Tools .	660	370		2,180	740	
49 General Supplies	850	980		1,890	1,920	
SUPPLIES	5,290	6,060	87	11,880	12,760	93
TOTAL	70,000	71,900	97	150,940	151,940	99

* Adjusted for Actual Volume

DATE ISSUED 3/12/56

EXHIBIT 2

for the shop under his control. He prepares a budget for expenses at or near normal volume, representing an average for the period of a business cycle which includes periods of high and low volume. Estimates of expense at normal volume are based upon current wage rates, salary standards, and prices for materials and purchased services, and also upon current operating efficiency. A budget is also prepared for at least two other levels of volume above normal and two below, based upon volumes ranging from the lowest to the highest level of production likely to occur.

A graph of percentage readings is then constructed for each item of expense to facilitate determining budget amounts at any volume level. The budget amounts are plotted for each expense item, using a chart with horizontal and vertical axes scaled 200 per cent, and a point is plotted reading 100 per cent on each axis and representing, thus, the position for the expense at normal volume. The budget amount for the particular expense category at the lowest level of volume, divided by the amount budgeted at normal volume, is marked as a per cent on the vertical axis. The production volume at the lowest level of operation, divided by the normal volume, is similarly marked on the horizontal axis.

The point on the graph determined by these two marks on the respective scales is plotted and the procedure is repeated for each other level of activity for which budgets are prepared. All points plotted are connected. If the line is straight, or reasonably so, it is extended to intersect the vertical axis. This point indicates the degree, interpreted as a percentage, that the cost is adjudged to be fixed (the complement represents the variable percentage).

Having once prepared the graphs, it is a simple clerical job to determine the budget amounts applicable to the actual volume of the shop each month. The ratio of actual to normal volume is first located on the horizontal axis of the graph. A vertical line from this point to the trend line on the graph establishes, by reading to the vertical axis, the per cent to be applied to the normal budget amount in order to adjust it for actual volume.

Reporting Weekly for Control of Labor Costs

Cost represented by wages paid to workers on the hourly payroll is a considerable part of the total cost of production. Therefore, considerable effort is made to be sure that management has the means with which labor costs can be controlled. Wage incentives are established for all jobs on which workers can be properly measured in terms of their output. With such a policy, it is important that management receive reports which show a measure of performance against the incentive standards. Such a report, as published weekly, is illustrated in Exhibit 3. The principal control data are the efficiency of labor operations for which incentive standards apply, the amount of downtime and an analysis of the downtime, and the proportion of labor for which incentive standards are in use. Major operations within each shop are shown separately. The report also includes labor activity in service departments. For TRANSITE pipe, the reader will note that, in the sample report, there is a separation into two major operations. Studying the data for the first operation, forming, it can quickly be seen that practically all of the work was covered by incentive standards, the efficiency of the men operating the machines was good, and the machines were down about three per cent of the time, an explanation of which would appear on the back of the statement. It may be interesting to note that two percentages of effectiveness are shown. One measures performance for the time when the machines are operating; the other for the total of operating time and downtime.

For expense labor related to the forming operation, the same analysis is reported. For this operation, such jobs as operating lift trucks and tending the steam-cure tanks are incentive operations, since means of measurement of output for these tasks have been developed. As is true for expense labor operations in

LABOR ANALYSIS REPORT

PLANT WAUKEGAN — WEEK ENDING FEBRUARY 12, 1956

Control Center	DIRECT ACTUAL HOURS TOTAL	DOWN	UNMEASURED	ON STD.	STD. HOURS	% EFF OPER.	% EFF DEPT.	% ON STD. DIR.	% ON STD. EXP.
Transite Pipe:									
Forming	4,590	140	155	4,295	5,150	120	116	97	19
Finishing	3,860	265	1,370	2,225	2,780	125	112	62	-
Shop X	1,650	75	95	1,480	1,700	115	109	94	30
Quality Control									
Shipping - Receiving									49
PLANT TOTAL	25,600	975	4,650	19,975	23,570	118	113	81	38

*Similar columns for expense appear in complete form.

EXHIBIT 3

the production department, in service departments also there are incentive standards for all operations which can be measured with reasonable accuracy. It will be noted that two service departments are included on the illustration. For shipping and receiving, usually, the greater part of the work can be measured.

Operating Reports — From Blending to Finishing

The statements discussed up to this point can be considered as company reports issued not only for the shop under discussion but also for each other manufacturing department. There are additional reports which were designed specifically for TRANSITE pipe operations. The basic steps for making this product line are three in number. First, blends are made. Each blend type consists of a dry-batch of asbestos fibres and finely ground asbestos cement scrap

DAILY FORMING REPORT

PRODUCT TRANSITE PIPE — DATE FEBRUARY 10, 1956

Product Description	Weight per Foot	No. 1 MACHINE — FEET PRODUCED				No. 2 MACHINE — FEET PRODUCED			
		1st SHIFT	2nd SHIFT	3rd SHIFT	TOTAL 3 SHIFTS	1st SHIFT	2nd SHIFT	3rd SHIFT	TOTAL 3 SHIFTS
4" Cl. 150 Pressure Pipe	6.3 lbs.	1,430	780	845	3,055				
6" " " " "	10.8 "	260	1,040		1,300				
8" " " " "	16.7 "	325	65	1,235	1,625				
10" " " " "	27.0 "					1,040	975		2,015
12" " " " "	37.0 "							910	910

TODAY'S PERFORMANCE	Standard Usage for Prod. M Lbs.	17.5	17.7	26.4	61.6	37.8	36.0	49.6	123.4
	Actual Usage for Prod. M Lbs.	18.6	18.9	28.0	65.5	40.5	39.2	54.0	133.7
	Actual / Standard %	106	107	106	106	107	109	109	108
	Tons Produced	8.6	8.6	13.0	30.2	18.5	17.7	24.3	60.5
	Machine Hours	7.8	7.7	8.0	23.5	7.9	8.0	8.0	23.9
	Tons per Hour	1.1	1.1	1.6	1.3	2.3	2.2	3.0	2.5
MONTH TO DATE	Actual Usage / Standard %	106	109	107	107	106	109	108	108
	Tons Produced	115.6	136.5	153.9	406	268.8	251.8	269.4	790
	Machine Hours	96.4	97.5	96.1	290	112.0	109.5	107.5	329
	Tons per Hour	1.2	1.4	1.6	1.4	2.4	2.3	2.5	2.4

FIBRE RECOVERY

UNIT LBS.

	M BLENDS			C BLENDS		
	PRODUCED	USED	DIFFERENCE	PRODUCED	USED	DIFFERENCE
Today	62,000	64,000	- 2,000	-	-	-
Month To Date	800,000	790,000	+10,000	223,500	224,800	- 1,300

EXHIBIT 4

in fixed proportion. Then, furnishes are produced. Cement, inert materials, water, and blends are mixed in predetermined quantities to form a wet mix called "furnish." Finally, pipe is formed. "Furnish" is transferred onto mandrels at the forming machine until the desired thickness of pipe is attained. The mandrel is then removed and the wet pipe is steam-cured.

At most of the TRANSITE pipe locations, there are three or more pipe forming machines and these are frequently operated on a three-shift per day basis. From the daily shop reports of production, usage, and direct labor, our personnel publish a Daily Forming Report (Exhibit 4) showing for each machine and each shift quantity of each type and size of pipe formed and of materials used for production, and hours of operations for each machine. Stan-

ards for material usage are multiplied by production quantities to determine the total standard quantity of usage for production. By comparing the total actual quantity of usage with the total usage at standard, it is obvious to what extent actual performance differed from the desired performance. Further, by converting the production quantities to tons and dividing the result by the operating time for the machine, management is presented with an important yardstick which indicates the effects of machine downtime. In addition, a tons-per-hour figure furnishes a common basis for comparing performances for each machine by shift. The month-to-date portion of the report permits a comparison of daily performance with that which has occurred so far during the month. The bottom section presents to management a daily record of fibre-blend production and usage.

The upper section of the monthly Variations-Forming statement (Exhibit 5), presents a comparison, by types of blends, of the actual usage of ingredients with the quantities which engineering standards indicated should have been used. It will be noted that total variance is also expressed in dollars. The center section presents, for the various types of furnishes, comparisons of actual to standard usage of ingredients. In the example, although the total actual weight of ingredients used to make furnishes was but two per cent greater than the standard allowance, the cost of actual usage was four per cent above the cost for standard quantities.

The formed stock section presents the usage of furnishes at each forming machine and shows a comparison with the engineering standards. Usage of felts is compared to a standard based on the number of pipe sections formed on the machine. Usage of steam at the curing operation is reported in comparison with standards for steam consumption.

The section of the report devoted to direct labor presents for each forming machine a detailed analysis of the dollars of labor cost expended in forming pipe. The values entered in the column for total actual labor are taken directly from payroll distribution records and are the dollars paid to the labor crews at each forming machine. Amounts shown in the standard labor column are those which were computed by applying the applicable standards to the quantities of pipe formed on each machine. The irregular labor columns present an analysis of the difference between the actual cost of labor and that computed as being the amount which would have been spent under standard operating conditions. Because the standards do include allowances for downtime and machine setups, the amounts shown in columns for these items represent only variances. Since there is nothing included in the operation standards for over-time premium, shift premium, or make-up pay, the total actual costs for these items appear as irregu-

VARIATIONS - FORMING

PLANT MAUKEGAN — MONTH FEBRUARY 1956

BLENDS — UNIT M POUNDS

Materials	PRESSURE (Tube)			PRESSURE (Swing)			NON-PRESSURE			TOTAL		
	STD.	ACT	%A/S	STD.	ACT	% A/S	STD.	ACT.	% A/S	STD.	ACT.	% A/S
AX Fibre	170	166	98	200	195	98				370	361	98
BX Fibre	200	207	104	150	155	103				350	362	103
CX Fibre	590	597	101	310	315	102	310	317	102	1,210	1,229	102
Total Fibre	960	970	101	660	665	101	310	317	102	1,930	1,952	101
Scrap	70	60	86	40	35	88	35	28	80	145	123	85
Total Weight	1,030	1,030	100	700	700	100	345	345	100	2,075	2,075	100
Total $	82,500	83,620	101	55,000	56,450	103	21,100	21,700	103	158,600	161,770	102

FURNISHES — UNIT M POUNDS

Furn. Group	BLENDS			INERT MATERIAL			CEMENT			TOTAL		
	STD.	ACT.	% A/S	STD.	ACT.	% A/S	STD.	ACT.	% A/S	STD.	ACT.	% A/S
15 %	118	120	102	232	230	99	355	360	101	705	710	101
20 %	255	260	102	350	350	100	565	570	101	1,170	1,180	101
25 %	1,320	1,350	102	1,265	1,280	101	1,880	1,945	103	4,465	4,575	102
Non-Pressure	340	345	101	343	345	101	570	575	101	1,253	1,265	101
Total Weight	2,033	2,075	102	2,190	2,205	101	3,370	3,450	102	7,593	7,730	102
Total $	155,400	161,770	104	8,850	8,910	101	33,100	33,920	102	197,350	204,600	104

FORMED AND CURED STOCK — UNIT M POUNDS

Machine No.	MATERIALS USED FOR FORMING			FELTS			STEAM		
	STANDARD	ACTUAL	% A/S	STD.	ACT.	% A/S	STD.	ACT.	% A/S
No. 1	2,885	2,950	102	2	2	100			
No. 2	4,708	4,780	102	4	3.7	93			
Total Weight	7,593	7,730	102	6	5.7	95	5,540	5,600	101
Total $	197,350	204,580	104	16,800	16,000	95	3,950	4,000	101

DIRECT LABOR — UNIT $

Operation	STANDARD LABOR	IRREGULAR LABOR					TOTAL ACTUAL LABOR	% ACT. STD
		DOWN TIME	SETUPS	O.T and S.P.	MAKEUP	OTHER		
Forming, No. 1 Machine	13,840	G 30	20	950	10	80	14,870	107
% of Total	93	-	-	6	-	1		
Forming, No. 2 Machine	18,900	20	G 20	1,430	30	170	20,530	109
% of Total	92	-	-	7	-	1		
TOTAL	32,740	G 10	-	2,380	40	250	35,400	108
% OF TOTAL	92			7		1		

Note: Variations marked G denote gains.

EXHIBIT 5

lar labor. The column for other labor includes the remainder of irregular labor, which can be the result of the following:

VARIATIONS - FINISHING

PLANT WAUKEGAN
PRODUCT TRANSITE PIPE
MONTH FEBRUARY 1956

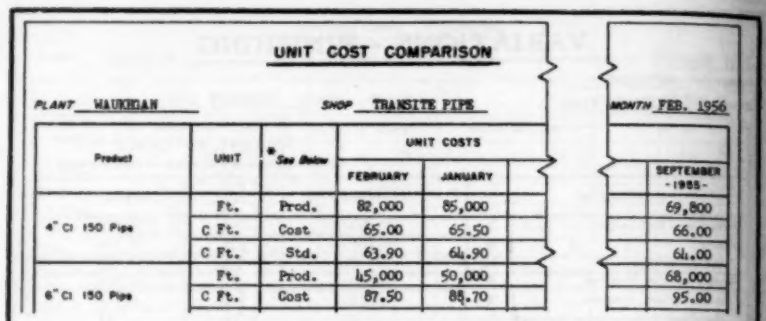
Description		PROCESS MATERIALS (Amounts shown are at values of formed stock) PRESSURE PIPE	TOTAL
Production - Full Lengths	$	141,500	205,500
Rejects	$	21,600	28,100
Initial Recovery	%	87	88
Random Lengths Reclaimed	$	16,800	20,500
Labor to Reclaim Randoms	$	1,950	2,960
Reclaimed Labor / Value Reclaimed	%	12	14
Net Loss	$	4,800	7,600
Ultimate Recovery - Actual	%	97	97
Ultimate Recovery - Standard	%	98	97

EXHIBIT 6

1. Machine speeds differ from established standards.
2. Crew size differs from standard.
3. Employees perform jobs for which the standard hourly wage rates are lower than their personal rates.

The percentage of cost to the total labor amount appears at the bottom of the statement and presents an interesting breakdown of each labor dollar. For example, look at the entries for forming pipe on the No. 1 machine. Ninety-three cents of the dollar is accounted for as the portion which standards indicated should have been spent at straight-time labor rates; six cents of the dollar was for overtime and shift premium payments; one cent of the dollar was due to other causes.

An analysis of pipe finishing operations is contained in the Variations—Finishing statement (Exhibit 6). The upper section contains an analysis by major product groups showing what was produced, what was rejected, and what portion of the rejects were reclaimed as good production. On the data given, management is informed that full-length production had a value of $141,500. The quantity of pipe rejected represented production costs totaling $21,600. Thus, initial recovery was at a level of 87 per cent. However, random lengths having a value of $16,800 were reclaimed from the rejects. This was done at a cost of $1,950 for reclaiming labor. Relating reclaiming labor to the value of production reclaimed, it can be determined that the ultimate recovery was at a level of 97 per cent. By applying engineering standards to the various quantities of production for products of this group, ultimate recovery



UNIT COST COMPARISON

PLANT MAUKEGAN SHOP TRANSITE PIPE MONTH FEB. 1956

Product	UNIT	* See Below	UNIT COSTS			
			FEBRUARY	JANUARY		SEPTEMBER -1955-
4" CI 150 Pipe	Ft.	Prod.	82,000	85,000		69,800
	C Ft.	Cost	65.00	65.50		66.00
	C Ft.	Std.	63.90	64.90		64.00
6" CI 150 Pipe	Ft.	Prod.	45,000	50,000		68,000
	C Ft.	Cost	87.50	88.70		95.00

* Prod. represents quantity of finished products made
Cost. is unit cost incurred for the month.
Std. is unit cost of production with standard usage priced at current prices.

EXHIBIT 7

at standard for the month's production was computed as being at a level of 98 per cent. The direct labor section of this report (not shown) is quite similar to that for the forming operation. Each major finishing labor operation has its comparison of standard to actual dollars, along with an analysis of the irregular items of labor.

Each month a report, statement of element costs, is prepared for products considered to be most representative of those regularly produced in the TRANSITE pipe shop. For each, a unit cost is computed, including for each element of cost actual usage valued at current prices and rates. Thus, the many variations from standards which have already been discussed are related to representative products so that management is informed as to the effect of actual performance upon unit costs.

Another monthly statement, Unit Cost Comparison (Exhibit 7), presents for representative major products a record of production activity and a comparison of actual cost with a cost based on standard usages at current prices and labor rates. Following unit costs at standard usage from month to month provides management with data as to the effect of changes in price and wage levels on unit costs. By elimination of the effect of prices and labor rates on these changes, the remainder of the unit cost change from month to month, i.e., the portion due to varying efficiency becomes readily available.

Managers and superintendents accustomed to using modern control techniques built around the basic principle of management by exception read the repetitive reports and often select items on which they desire more information. Their questions usually begin with "Why?" "What caused?" or "Can you give me more data on ————————?." These questions may be directed to their own subordinates or directly to financial personnel. However, even in many cases in which the questions are asked of others, the answers, or parts, are obtained from cost personnel. Obviously, the person who prepared the financial statement which caused the question to be raised is frequently in the best position to furnish further information. It behooves every person who prepares such repetitive data to realize the fact that the value to the enterprise of actions taken as a result of answers to additional questions frequently justifies not only the work of preparing such answers but also the work on the statement which caused the question to be raised.

To achieve the maximum benefit from the control tools in any cost system, provision must be made to keep it current. Data being reported should be that which is designed to give recognition to current conditions in respect to products, processes, and administration. Communication of data must be kept as effective as possible, not only in regard to regularly prescribed statements but also as to special reports, whether prepared on the analyst's own initiative or upon request from production management. Two tests should be continually applied to work performed as an aid to cost control. These are:

1. Is this effort making as much of a contribution to maintenance and improvement of profit as it possibly can?
2. Does the value derived from this effort justify the cost incurred?

In the control tools used for our TRANSITE pipe operations, we believe there will frequently be opportunities for further improvement. However, results so far indicate that much has already been accomplished. Financial personnel who aided in the devising of methods, administration of the cost system, and preparation of analyses, have a right to take pride in their contributions toward the overall achievement.

OTHER INCOME, OTHER PROFIT by LAWRENCE B. KENNY*

A HISTORY OF A BUSINESS will often show that it was established to manufacture a single line of products or render a single type of service. The only source of income contemplated at the beginning was from the sale of chief products or services. Accordingly, the chart of accounts for sales income in the ledger, together with corresponding accounts for returns, allowances, etc., were generally enough to satisfy the needs of management for revenue detail.

However, in many types of business, increased competition, rising costs, and changes in buying habits have depressed the profit formerly realized from the main products. Meanwhile, new sources of revenue have been, and frequently are being, discovered. A few of the many types of other income are the sale of containers or packaging materials in which raw materials are received, the sale of trimmings from stamping, cutting, or machining operations, the sale of obsolete office records to waste paper dealers, purchase discounts, and income from vending machines or pay telephones located on property.

Although these types of income have generally been contributing an increasing share to the overall profit picture, the financial statement has not, in most cases, kept pace. When this revenue is recognized on the profit and loss statement, it is generally lumped under the heading of miscellaneous or other income. Due to the conventional accounting setup, such revenue is frequently considered as a capricious windfall rather than as a quite dependable source of profit which can and should be fully exploited.

Inasmuch as most types of other income bear a direct relationship to sales, purchases, the passage of time, or other readily available indices, the potential contributions of each can be measured and the results checked on each statement. A survey can be made to find out how much income can be expected from each source, proper yardsticks set up, and income accounts opened to adequately collect the information. This is an important aid to management in achieving the maximum profit from the business. Naturally, any expense which may occur in procuring the additional income should be charged into the account in order to get a true picture. The statement in Exhibit 1 show one approach to keeping management well informed as to the sources of its profits.

An analysis of this statement shows that the business broke even on its pre-

(*Continued on page* 88)

* Chief Accountant at the Pontiac, R. I., division of Fruit of the Loom, Inc.

Another Look at Accounting for Idle Capacity

by NEIL CHURCHILL

IDLE CAPACITY CAN BE DEFINED as the length of time a given quantity of the company's resources have not been furthering the enterprise's objective during any period. This is a broad concept for, within its framework can be included the time spent by the employees of the firm waiting for work, for inspectors, or for instructions from supervisors and the time that the productive capacity of the plant and equipment is not being utilized, as during material shortages, periods of depression, or other work stoppages. The causes may vary but the central fact remains.

One author classifies the causes of idle capacity into three main groups: production, administrative and economic. (W. P. Fiske, "Accounting for Unused Facilities," *N.A.C.A. Bulletin*, November 15, 1931). They may be further divided in the following manner:

1. Production causes
   a. Repetitive machine adjustments
      1. Set-up and change over
      2. Repairs and adjustments
   b. Lack of materials or tools
      1. Internal
      2. External
   c. Lack of supervision, inspection, instruction
   d. Lack of power
      1. Internally produced
      2. Externally produced
2. Administrative causes
   a. Excess plant for anticipated expansion
   b. Production balance
   c. Special machines used for one or two jobs
   d. Nucleus or core of labor force
   e. Some strikes
3. Economic causes
   a. Seasonal
   b. Cyclical
   c. Industrial

Costs of Idle Capacity

Costs of idle capacity arise from idle employees and idle facilities. As attributable to idle employees, these costs can be such cash flows as base wages paid, employer's share of payroll taxes, and employee's insurance premiums. Noncash value releases can be either directly attributable, such as accrued retirement benefits, or indirectly attributable, such as a portion of a subsidized

NEIL CHURCHILL is associated with the University of Michigan, where he is working on his doctorate degree. Previously he worked two years in public accounting. Mr. Churchill is a CPA in California.

cafeteria or of payroll department costs. When workers are assigned below skill to keep them, management incurs the idle capacity cost by policy.

Value releases attributable to idle facilities can be classified as deterioration with time, reduction in value due to approaching obsolescence, and specific value releases for upkeep, readiness and protection of value, such as insurance and taxes, maintenance and repairs, and shelter and protection. These do not arise because the facility is idle but would be approximately the same if the facility were productive. The classification as idle cost results because these costs are incurred when no economic resource but capacity is being received.

Apportioning Costs to Idle Facilities

When a facility is idle for a whole period, many of the costs of its idleness may be directly determinable. Even when a part of a facility is idle during the whole period such a determination may be made. Let us assume an H-shaped factory building with the center bar one-half the length of either side. It is thus composed of five equal parts. If one of the four "wings" of the building is unoccupied and partitioned off from the remainder of the building, it is conceivable that the costs attributable to it could be obtained as follows:

Value Release	Whole Building	Empty Wing	Occupied Area
Depreciation and obsolence	$4,000	$ 800	$3,200
Heat and light	1,000	...	1,000
Property taxes	500	100	400
Insurance (building)	1,500	300	1,200
	$7,000	$1,200	$5,800

Even in such a straightforward example, expenses for plant protection and maintenance of grounds complicate the problem and, when a facility is idle only part of the period under consideration, the problem of determining the cost of idleness is one of both the apportionment of the value releases to the facility and the allocation of them between the idle and the productive period. The best and most practical solution to the problem is the accumulation of the costs attributable to the productive and partly productive facilities in overhead accounts and an allocation of this overhead to production and to idle capacity by the use of a burden rate. Production is equated, in this sense, with the utilized plant capacity during the period. Thus the problem is divided into two parts. How much of the cost attributable to the entire facility is to be assigned to the overhead accounts prior to any proration based on activity to production and idle capacity? How much of the assigned overhead costs should be attributable to production and how much to idle capacity?

If the capacity of the facility is used in determining the maximum capacity of cost centers and the maximum capacity of each cost center is taken into account with the actual utilized capacity in determining the overhead allocations, then all the specific costs of the facility should be entered into the overhead accounts. If the capacity of the facility is not used in the determination of the maximum capacity of the cost centers, then an allocation between the portion used in these cost centers and the portion that is idle is necessary before these specific costs are distributed to the cost centers.

To illustrate this, let us consider that our H-shaped plant is built for a production using 1,000,000 direct labor hours per year. At present, however, machinery is installed in only three of the wings and the center section of the plant, one of the wings is vacant. Assume further that the maximum attainable production for the past year could use 800,000 hours and that actual production used 600,000.

If, for simplicity's sake, it is assumed that all the costs attributable to the plant are incurred proportionally in both the occupied and the unoccupied areas, it is apparent that four-fifths of these costs are charges to the current year's overhead accounts and the remainder is chargeable as a cost of idle capacity. These occupied-plant costs would then be allocated with the rest of the overhead costs between production and idle capacity. If current plant costs are proportionate to direct labor hours, it would mean that the three-quarters (600,000 in ratio to 800,000) of overhead costs allocable to the equipped (occupied) area are also chargeable to production and one-quarter as idle capacity cost. The portion of the plant costs to charge to idle capacity is therefore one-fifth of the cost attributable to the facility plus one-quarter of the four-fifths attributable to the productive area. This works out as follows:

$$\text{Idle capacity cost} = 1/5 + (1/4 \times 4/5) = 1/5 + 1/5 = 2/5 = 40\%.$$

This is just what would be expected when 600,000 direct labor hours are worked out of a possible 1,000,000. Were all of the plant costs to be charged to factory overhead and then allocated btween production and idle capacity, production would be charged with the proportion of 600,000 to 800,000 or 75 per cent, and idle capacity with the rest or 25 per cent. This is obviously incorrect, since 60 per cent of the intended productive capacity of the plant was used and all costs were assumed to occur proportionally to the direct labor hours worked.

In practice, to determine the amount of the overheard attributable to production and the amount attributable to idle capacity (done on a labor hour basis above), one of several rates of activity may be used. The actual activity during the period, divided by the theoretically available activity for the

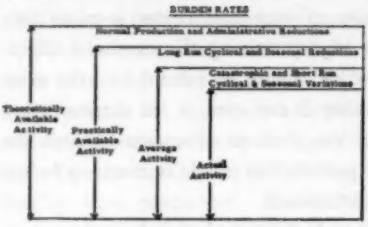


EXHIBIT 1

period, is the ratio which should be applied to the overhead costs to determine the proper allocation between production and idle capacity. Many different activity rates are used. The diagram in Exhibit 1, adapted from one originally developed by Edward P. Rush (*N.A.C.A. Yearbook*, 1930), shows the various rates of activity available or in common use.

The use of a burden rate based on theoretically available activity would allocate the overhead to production and idle capacity based on the total productive and nonproductive time during the period. The use of a burden rate based on the actual activity would allocate all the overhead costs to production. The use of the burden rates in between results in different amounts of the idle time costs allocated to production, and are the ones most commonly used in business today. Some advantages of each are listed below:

Average activity rate

1. Charges all factory costs to the product over the business cycle.
2. Results in a "more realistic" inventory value.
3. Gives a sound basis for pricing the product, for the price has to cover all costs in the long run.
4. Is an attainable level of activity, and hence, is not discouraging in its motivational aspects.

Practically available activity rate

1. Determines an excess capacity cost that is a cost of idleness, not a cost of unusual idleness.
2. Results in a cost of idleness that is not composed of offsetting amounts. This is of importance in "management by exception."

The advantages claimed for each rate are for the most part sound. A close examination will disclose that these advantages arise because the different rates result in cost data suitable for different purposes and not that either rate is better than the other.

Why Account for Idle Capacity Costs?

The determination of the costs of idle capacity is undertaken for the following reasons:

1. To separate them from the costs of production to prevent distortion and confusion in analysis of the latter.
2. To facilitate income determination.
3. For control purposes.
4. For planning purposes.

The first reason reflects consideration of costs as a measurement of a purposefully incurred value release. The value release occasioned in the productive process should be distinctly measureable. This can only be done when unrelated costs are removed.

The application of idle capacity costs to the determination of income encounters complications. Some are product costs, some period costs, and others losses. It is almost a universal practice to charge the idle capacity costs resulting from the causes classified as internal production causes to the product. Many of these are not even measured by most accountants but are automatically charged to product when either the practical, average, or actual activity burden rate is used. Difference of opinion arises over the allocation of the costs of retaining a nucleus of the labor force. Some say that these costs should be charged to the product, other that they have nothing to do with production and are the costs of the period in which they occur. While some difference of opinion exists as to the allocation of the costs of seasonal idle capacity, mose accountants subscribe to its being included in the cost of production as normal to the particular product involved.

The treatment of the costs of cyclical idleness varies between those who advocate the practically available activity rate and those who advocate the average activity rate. These cyclical costs are automatically allocated to the product when the average activity rate is used. Most users of the practically available activity rate advocate charging the costs of idleness, as they determine them, to the period, although some modify this practice and adjust the inventories and cost of goods sold to reflect pro-rata absorption of the cyclical costs of idleness. Unanimity does prevail in charging to the period costs associated with abnormal and unanticipated idle time, considering them to be losses.

The third reason for the determination of the idle capacity costs is for control purposes, to point out the areas needing managerial attention, in line with the principle of management by exception. This principle needs sensitive indicators for it to function effectively. The amount of time the men and the productive facilities are not working is such an indicator.

Finally, management needs a variety of data to evaluate the different alternatives with which it is faced. Data in which too much has been merged will be meaningless for many of these purposes. It is for this reason that the proper determination of the costs attributable to idle capacity is important.

(*Continued from page* 82)

THE ACME COMPANY

Profit and Loss Statement

Income from sales	$1,000,000
Less ret. & allow.	50,000
Net sales income	950,000
Plus other income	50,000
Net total income	1,000,000
Cost of goods sold	900,000
Gross profit on sales	100,000
Administrative expense	50,000
Net profit for period	$ 50,000

Other Income

Sale of raw material containers (4% of purchases-$28,000)	$21,000
Sale of trimmings (3% of materials used-$18,000)	18,000
Sale of pickling tank residues (1/2% of materials used-$3,000)	3,000
Sale of office records ($85 per month-$1020)	1,000
Purchase discounts (1% of purchases-$7,000)	7,000
Total other income	$50,000

Cost of Goods Sold

Direct materials	$	
Invent. at start		100,000
Purchases		700,000
Total		800,000
Invent. at end		200,000
		600,000
Direct labor		100,000
Supervision		50,000
Rent		100,000
Maintenance		30,000
Insurance		10,000
Taxes		10,000
Cost of goods sold	$	900,000

Administration

Officers sal.	$20,000
Clerical sal.	20,000
Supplies	6,000
Taxes	2,000
Total	$50,000

EXHIBIT 1

sumed sources of income. All of the $50,000 profit is due to other income. A perusal of the other income schedule indicates at a glance that the full benefit of other income has still not been realized. The sale of raw material containers fell far below the expected figure of $28,000 to an actual figure of only $21,000. With this information, management is able to investigate the item intelligently to find out whether or not containers are being salvaged and sold to the best advantage. Such yardsticks are naturally rough but extremely indicative.

The most significant thing about other income is that it usually costs little if anything to generate in comparison to sales of standard products. For example, a product with a marginal income of 25 per cent requires $4,000 in sales to produce each $1,000 in profit. However, other income gentrally yields $1,000 of profit for each $1,000 of sales made or discounts taken. With steadily rising prices for materials, improvements in technology making previously discarded items now reclaimable, shifts in consumer patterns and other changes in our economy, profits from new sources are expanding. The accounting records of every business should help management to keep pace.

Accounting for a Travel Promotion

by WILLIAM W. BOWEN

WHILE THE IDEA OF TRAVEL PROMOTIONS is not a new one, the current widespread use of this "vehicle" to promote the sale of merchandise warrants review of the problems which it brings to the accountant. This article will take a particular instance and show, step-by-step, how the project was operated and accounted for.

A travel promotion is basically like any other contest, with a trip as the prize to be won. For this reason, it is of primary importance to determine why the contest is to be run and how much merchandise it is hoped to sell as a result. The contest, itself, is then established and tied very closely with the budget for funds to be spend on the promotion. It is a part of operating the contest to make all travel arrangements, so that the prize awarded is adequate. Finally, there must be a report to management reviewing the results.

The trip serving as illustration here was known as the Las Vegas Radio Roundup. In early 1954, The TV-Radio Division of Westinghouse decided to present a travel promotion for the sale of radios. This contest was to be a sequel to the 1953 "European Holiday" promotion which moved enough television merchandise to take 443 persons to Europe for a 12-day all-expense paid vacation. The purpose of the 1954 radio promotion was to sell to dealers 350,000 radios during the period May 1 through August 31 inclusive. At the time of announcement, the contest was to end July 31 but it was planned that, if necessary, it would be extended to August 31. The "pay-off" was to be taken early in October, a time indicated as ideal for a Western vacation.

Sharing of Costs; Estimating the Pull

Since the purpose of the contest was to sell distributors' as well as factory inventories, it was felt that the distributor should share a portion of the cost. This cost was related to model costs by varying percentages, and the percentages applied to divide the cost between factory and distributors also varied with the model and type, but were generally averaged so that the distributor would pay 25 per cent of the cost of the promotion and the factory 75 per cent. After the amount to be billed and the amount to be accrued were determined in this

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WILLIAM W. BOWEN *(SCRANTON CHAPTER 1956)*, is Accounting Manager for Haddon Craftsman Division, Inc., International Textbook Company, Scranton, Pa. Mr. Bowen was formerly Assistant to the Sales Manager for the Television-Radio Division of Westinghouse Electric Co., during which time he handled budget and accounting details for three major travel promotions.

manner, it was relatively simple to apply these figures to the inventory which was to be available and to arrive at the total accrual available for the promotion. Since experience on the "European Holiday" had shown that a point system was flexible and readily controllable, the next step was to assign point values to each model radio in the contest, based on the cost and features of the model. Again, arithmetic then gave the total possible points which could be won if the entire stock of merchandise was sold.

At this point we arrived at the crucial stage of promotion budget preparation which is to estimate the percentage of radios that will be sold but which will *not* result in a trip won. Again, falling back on prior experience, 40 per cent of the television sets sold during the "European Holiday" went to "go" dealers and 60 per cent went to the "no-go" dealers. In order to be somewhat conservative and because we had no experience on radio, we used the reverse ratio for budgeting purposes. After we had arrived at the total points that would be used by the "go" dealers, we then established the total number necessary to win a trip. This was done by trial and error until the total number was within reach of a sufficient number of dealers to make the promotion successful both as to merchandise sold and to persons making the trip. In determining this total, normal buying history was considered, industry trends for the coming contest period were reviewed, the average number of assigned points per radio was noted and some very good "crystal-ball" work on the part of the sales manager adjusted other factors.

We now had the expected number of trips and, knowing the cost per trip, had also the total cost of this element of the promotion.

Budgeting the Costs

The cost of the contest promotional material was determined by the advertising agency and the factory sales promotion department. These costs included trade paper advertising, the direct mail campaign, the "kick-off" announcement which was handled by a conference telephone call to all distributors, and incentive trips for distributor and factory sales personnel.

The administrative expense budget was determined mainly by experience obtained from the "European Holiday". However, it is of prime importance and merits review in detail.

First, there were traveling expense prior to actual trip. These covered travel to the advertising agency and travel agency offices, because this extra travel would not be included in normal departmental budgets. It was a management decision that salaries of factory personnel necessary to handle the detail of the promotion would not be charged to the promotion but would be absorbed in

normal budgeted operations. However, if this decision had not been made, then personnel costs would have had to be included. An amount was included for auditing of distributor records on the contest so as to insure accuracy and to prevent the possibility of collusion of distributors with dealers which would unbalance the ratio of "go" to "no-go" dealers. Also included was the cost of a preliminary trip to Las Vegas to "firm up" publicity and other details.

A second administrative expense category was mailing, stationery, telephone, etc. An amount was included for these very necessary items so as not to distort regular departmental budgets. Entertainment expense was established to give a "plus" to the trip iteself, in that at Las Vegas factory personnel would be called upon to entertain groups of dealers, possibly on their own free time while at the resort. Administration expense at Las Vegas was budgeted as an amount to cover such things as car rental for factory personnel to shuttle between hotels and on the spot expense, such as finding that "missing" dealer, etc. Expense at charter take-off points covered the cost of rooms and refreshments at New York and Chicago, which were take-off points for the chartered aircraft. There was also a provision for contingencies. All of these items, along with an allowance to the publicity department, covered the entire budget as we saw it at the beginning of the promotion. (Exhibit 1)

LAS VEGAS RADIO ROUNDUP - BUDGETED ACCRUAL & EXPENSE

Budgeted accrual

Current models inventory - 4 - 30 - 54				Trade paper advertising		
Factory inventory (including May production)		195,981		8 Ads - "Retailing Daily"	$3,960	
In transit inventory		2,362		2 Ads - "Electrical Merchandising"	1,590	
Distributor inventory		151,912		2 Ads-"Mart"	1,450	
Total inventory		350,255		Preparation costs	3,000	$10,000
Distributor portion of accrual			$ 87,563.75	Publicity		2,500
Factory portion of accrual			262,691.25	Incentive trips		
				Wales		
Distributor - old models inventory - 4 - 30 - 54		12,998		Regional managers	3	
				Wesco distributors		
Distributor portion of accrual			12,998.00	Regional managers	3	
Factory portion of accrual			None	Branch managers	17	
Total budgeted accrual			$363,253.00	Salesmen	37	
				Independent distributors		
Trip Expense				Managers & executives	7	
Total possible points - current models		1,711,791		Salesmen	34	
Total possible points - old models		63,244		Supplemental distributors		
		1,774,435		Executives and/or salesmen	34	
40% of points to "no Go" dealers		709,774		Total incentive trips ($5325)	95	30,875
60% of points to "go" dealers		1,064,661				
		1,774,435		Kickoff conference call		3,000
Budgeted trips @ 1400 points per trip		760		Total promotion expense		$ 74,375
Total trip expense @ $325			$247,000.00			
				Administrative expense		
Promotion expense				Travelling expense prior to actual trip	2,500	
Mailing campaign (including kickoff material)				Mailing, telephone, stationery, etc.	2,500	
Kickoff & 70,000 postcards	$30,380			Entertainment by factory personnel	1,750	
Direct mail to dealers, salesmen & European holiday guests	7,150			Administration expense at Las Vegas	1,000	
Creative art	1,000			Expense at charter take off points	1,500	
Type, artwork & mechanical	4,800			Misc. contingency	2,000	$11,750
Mailing costs	2,000			Factory management trips - 10 @ $325		3,250
Overtime	1,700	$ 39,000		Total administrative expense		$ 15,000.00
				Total expense		$325,375.00
				Contingency		$ 28,878.00
				Total (budget above)		$363,253.00

EXHIBIT 1

In determining the cost of the trip, there are two phases which must be considered and budgeted separately, the "ground" cost (hotels, meals, sight seeing, etc.) and the transportation (in this case, "air" costs). In determining the cost at Las Vegas, we invited bids from various travel agencies after having given

LAS VEGAS RADIO ROUNDUP—POTENTIAL DIVISION COST

Sets sold	350,000	300,000	250,000	200,000	150,000	100,000
Accrual						
Factory	$262,500	$225,000	$187,500	$150,000	$112,500	$ 75,000
Distributor	100,500	88,000	75,500	63,000	50,500	38,000
Total	$363,000	$313,000	$263,000	$213,000	$163,000	$113,000
Expense						
Trips	$247,000	$211,900	$176,800	$141,375	$105,950	$ 70,525
Promotion	74,375	74,375	74,375	74,375	74,375	74,375
Administrative	15,000	15,000	15,000	15,000	15,000	15,000
Total	$336,375	$301,275	$266,175	$230,750	$195,325	$159,900
Contingency	26,625	11,725	3,175	17,750	32,325	46,900
Net factory cost	$235,875	$213,275	$190,675	$167,750	$144,825	$121,900
Net factory cost per set sold	.67	.71	.76	.84	.96	1.21

EXHIBIT 2

them the general length of time set aside for the trip and the general type of activity and entertainment desired. From the bids submitted by the travel agencies and the services which they offered, management determined which agency was to handle the trip. It was then necessary for the law department of the corporation and the travel agency to draw up the final contracts.

The transportation costs are more difficult to determine because the points from which trip participants are coming cannot be known in advance. We obtained two charter flights—one from Chicago and one from New York, in order to reduce costs. Airlines personnel cooperated magnificently with us in holding space up to the last minute of departure. The transportation was handled exclusively by the travel agency and the airlines and succeeded in bringing 233 persons into Las Vegas within a period of about eight hours.

Keeping a Clear Picture of Risks Involved

In any promotion of this type, there is always the possibility that its final success may not be up to expectations. For this reason and always mindful of his responsibility to management, the accountant should present analyses which will show potential costs at many levels of success for the promotion (Exhibit 2). The details covering these various levels are presented so that the risk to management is more clearly realized at the time of approval of the final budget and promotion.

Progress and Final Reporting

After the promotion has been budgeted, approved by management and launched, it becomes the accountant's important function to report progress of

sales stimulated by it. The manner of reporting them is more or less dependent upon the type of product being sold, its manner of distribution, the type and size of the organizations to which it is sold, and the length of the contest. Two very important phases of this activity should be considered. One is that the more frequent the reports, the more knowledge of sales will be available to "plus-up" the promotion by bonus points, direct mailing campaigns or added incentives. On the other hand, the more frequent reports require more time for personnel to accumulate this knowledge, which may result in added costs for managing the contest.

During the Las Vegas Radio Roundup, a weekly report was required from the distributors for each dealer who had made purchases during the week. This report was developed so that it coincided very closely with other reports which the distributor was obligated to prepare as part of his agent agreement with the factory. These reports showed dealer purchases and points accumulated. When a dealer had won a trip, a congratulatory letter was sent to him, at which time he was asked to name the person who would represent him on the trip. Upon receipt of this name, it was passed on to the travel agent who could then take over his part of the trip "pay-off."

During any travel promotion, the accountant, in particular, must never allow the purpose to be neglected or to become subservient to the trip. It may be extremely difficult for him to relate to this purpose champagne parties, lavish dinners, and unusual promotional features which lend much to the success of the contest. The accountant is trained to watch pennies and to account meticulously for all types of expense. However, he must also become "sales-minded" to the extent of understanding that unusual expenses for an outstanding travel promotion must be made to make it better and different from other travel promotions. He must understand that the dealer has, generally speaking, worked hard to win the trip and that appreciation and loyalty to the factory may be spoiled by holding back approval of a relatively minor expense.

It is common, after the trip has been taken, for the sales and sales promotion departments to forget it and to be working on the next idea, which may now be in the embryo state. But the accountant must not share in this forgetting. It becomes his duty to follow all loose ends to a satisfactory conclusion. He must make sure all bills have been paid either by the travel agent, if they are his responsibility, or by the factory. He must prepare a final report which will detail actual accruals and expenditures as against the budget. Overexpenditures should be explained and, of utmost final importance, it is necessary to tell management how much merchandise was sold as a result of the promotion, as well as, if possible, how much these increased sales cost per unit.

Beyond These Covers

Books

Installing Electronic Data Processing Systems

Richard G. Canning, John Wiley and Sons, 440 Fourth Ave., New York 16, N. Y., 1957, 193 pp., $6.

A practitioner in the systems field, this author has provided a compact yet comprehensive text which begins where most companies do and goes on by practical stages through the job which the title of the work identifies. Among illuminating tables is one on page 105 listing and indicating responsibility for "Variables to Consider in EDP Installation."

Materials and Methods of Sales Forecasting

American Management Association, 1515 Broadway, New York 36, N. Y., Paper Bound, 1957, 239 pp., $5.25.

Collected addresses from an A.M.A. conference held last May are offered here in fifteen or more papers, partly grouped by industry (under techniques of forecasting) and partly by topic, e.g., "basic forecasts," "sources of outside information." The final grouping is one specifically of case studies, including three on "finance and manufacturing planning from the sales forecast." Appendices deal with outside sources of data for forecasts.

The Investment Decision

John R. Meyer & Edwin Kuh, Harvard University Press, Cambridge, Mass., 1957, 266 pp., $5.50.

Accountants will find a familiar problem but not familiar terminology in this book. Plant and equipment investment data relating to specified industries are central to the text which also concerns inter-actions between investment decisions and economic growth.

The State of Economic Science

Tjalling C. Koopmans, McGraw-Hill Book Company, 1957, 231 pp., $6.50.

An economist's book written largely for economists, inclusion of a note on it here is for economically-minded accountants. The title page precedes the book title proper with the words, "Three Essays On." Their individual titles are "Allocation of Resources and the Price System," "The Construction of Economic Knowledge," and "The Interaction of Tools and Problems in Economics."

Articles

Recognizing and Evaluating Your Profit Opportunities

Frank S. Capon, The Controller, October 1957.

An extensive investigation procedure is outlined by the author of this article, with a graphic illustration of "the path of planned company development." Old products, new products, diversification and expansion are topics recommended for inclusion in a study.

A Proposal for Determining the Significance of Variations from Standards

A. W. Patrick, Accounting Review, October, 1957.

Starting with the point that, ". . . isolation of variances is a relatively easy task" and that their significance is equally important and more difficult, this author suggests and illustrates "judicious use of statistical methods" for this purpose.

Centralized Control of Decentralized Operations

Al. N. Soares, Advanced Management, October 1957.

The concern of this article is that the "modern management executive — understand the powers and limitations of methods and disciplines so that he can ask the right questions of the right people to get the information he really needs."

Price Level Changes, Inventory Valuations and Tax Considerations

Alan Robert Cerf, Accounting Review, October 1957.

Developed here are several models showing effects of various methods of inventory valuation on tax liabilities over a four-year inflationary period. "Fifo," "lifo," average cost, cost or market, and market are alternatives dealt with.

More For Your Capital Dollar

John A. Griswold, The Controller, October 1957.

Alternative methods of basing and computing return on investment are treated in this article, including discount, cash payback, average payback, and average investment methods, the latter three considered as "short-cut" methods.

Capital Expenditure Analysis Procedure

David R. Platt, Advanced Management, October, 1957.

Tables and forms for application of a capital outlay evaluation procedure "based on the concept of present value of money" are central to this paper, offered as a guide to selection of most profitable investment alternatives.

Analysis and Control of a Cash Flow System

Martin H. Kellogg, The Controller, October 1957.

Exploring the possibilities and importance of determining and controlling the "velocity" with which company money turns over in its operations, the author of this paper sketches methods for shortening the time cycle of complete flow and presents a control chart disclosing "action" points.

Accounting and Reporting Standards for Corporate Financial Statements — 1957 Revision

Committee on Concepts and Standards Underlying Corporate Financial Statements (committee of the American Accounting Association), Accounting Review, October 1957.

This is the text of the 1957 revision of a statement issued first in 1936, revised in 1941 and 1948, and affected from 1951 to 1955 by eight "Supplementary Statements" issued by the present committee. Responsibility for the revised statement is specified to lie with the committee and commentary is offered by R. K. Mautz, Committee Chairman, in an article following the text. Publication of the statement was authorized by A.A.A.'s executive committee.

Planning Concepts in the "Tentative Statement of Cost Concepts"

Barbydt, Clement, Lufkin, and Yorke, Accounting Review, October 1957.

The reference in this article is to a "Tentative Statement of Cost Concepts Underlying Reports for Management Purposes" issued in 1956 by a committee of the American Accounting Association. The present paper examines the *costs for planning* portion of the statement.

Addresses of Periodicals

Accounting Review
c/o R. Carson Cox, College of Commerce, Ohio State University. Columbus 10, Ohio, Single copy $1.50.

Advanced Management
74 Fifth Ave., New York 11, N. Y., Single copy $1.

Computers and Automation
815 Washington St., Newtonville 60, Mass.

Controller
2 Park Ave., New York 16, N. Y., Single copy, 65¢.

Office Equipment News
146 Bates Road, Montreal, Canada.